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File: M03. EPA [06E11000-2014-F-0200]
(Remedial Design Unit 10 Warm Springs Creek Remedial Actions)

July 3, 2014

Charles Coleman, Anaconda Project Manager
U.S. Environmental Protection Agency, Region 8, Montana Office
10 W. 15th Street, Suite 3200
Helena, Montana 59626

Dear Mr. Coleman:

This document transmits the U. S. Fish and Wildlife Service's biological opinion (BO) based on our review of the proposed Remedial Design Unit 10 Warm Springs Creek Remedial Actions and its effects on bull trout (*Salvelinus confluentus*) and bull trout critical habitat in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). Your request for formal consultation bull on trout was received on March 19, 2014.

The enclosed BO for bull trout is based on information provided in the March 2014 biological assessment prepared for this project, telephone conversations, and electronic mail with Environmental Protection Agency (EPA) personnel, and other sources of information. The EPA determined that the proposed action will have adverse effects to bull trout and bull trout critical habitat. A complete administrative record of this consultation is on file in this office.

Please note that if conditions change such that the analysis in the enclosed BO is no longer accurate, reinitiation of formal consultation may be necessary provided the EPA retains discretionary Federal involvement or control over the action. We appreciate your interest and cooperation in meeting our joint responsibilities under the Endangered Species Act. Should you have any further questions, please contact me or Dan Brewer of my staff at (406) 329-3951.

Sincerely,

Tim Bodurtha

for Jodi L. Bush
Field Supervisor

Enclosure: Biological Opinion for Bull Trout, Environmental Protection Agency, Warm Springs Creek Remedial Design Project 2014

Copies To: AES, R-6, MS 60120 (Attn: Doug Laye)
Montana Department of Fish, Wildlife, and Parks, Helena, MT (Attn: Jeff Hagner)
File: 7759 Biological Opinions - 2014

Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION
on the
Effects to Bull Trout and Bull Trout Critical Habitat
From the Implementation of Proposed Actions Associated with the
Remedial Design Unit 10 Warm Springs Creek Remedial Actions
2014

U.S. Environmental Protection Agency
Region 8, Montana Office

U.S. Fish and Wildlife Service
Montana Field Office

July 3, 2014

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I. Introduction and Consultation History

This biological opinion (BO) addresses project related effects to the threatened bull trout (*Salvelinus confluentus*) and bull trout critical habitat in accordance with the Endangered Species Act (Act) of 1973 as amended (16 U.S.C. 1531 et seq.). The U.S. Fish and Wildlife Service (Service) based this opinion on our review of the Remedial Design Unit (RDU) 10 Warm Springs Creek Remedial Actions, biological assessment (BA) prepared by CDM Smith for the U.S. Environmental Protection Agency (EPA) and on additional information in our files.

Section 7(b)(3)(A) of the Act requires that the Secretary of Interior issue biological opinions on federal agency actions that may affect listed species or critical habitat. Biological opinions determine if the action proposed by the action agency is likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. Section 7(b)(3)(A) of the Act also requires the Secretary to suggest reasonable and prudent alternatives to any action that is found likely to jeopardize the continued existence of listed species or result in an adverse modification of critical habitat, if any has been designated.

This BO addresses only the impacts to the federally listed bull trout and bull trout critical habitat within the action area and does not address the overall environmental acceptability of the proposed action. On March 19, 2014 the Service received a final BA that analyzes the impacts to bull trout and bull trout critical habitat from the removal of contaminated soils from the Warm Springs Creek floodplain.

II. Description of the Action Area and Proposed Action

The proposed action will occur in the Clark Fork River Section 1 (a.k.a. Upper Clark Fork River) core area and in the Upper Clark Fork River Critical Habitat Subunit (CHSU). This core area and CHSU share the same geographical boundary. The proposed action will affect one local population and one water body (Warm Springs Creek) designated as critical habitat. The portion of Warm Springs Creek in the action area functions as foraging, migratory, and overwintering (FMO) habitat.

The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this BO encompasses a section of Warm Springs Creek from its confluence with the Clark Fork River upstream approximately 15 miles to Meyers dam. The action area is the portion of the total area where activities and activity-related impacts may influence the habitat, movement, habitat use, and persistence of bull trout. Within the action area two project areas have been identified, Section 32 and Lower Warm Springs Creek.

The following summary of the proposed action is taken from the BA (U.S. Environmental Protection Agency 2014):

The RDU 10, Warm Springs Creek Remedial Design project area is located at the southern end of the Deer Lodge Valley, near the location of the former Anaconda Minerals Company ore processing facilities. The processing facilities at the site were developed to remove copper from ore mined in Butte from about 1884 through 1980. Milling and smelting produced wastes with high concentrations of arsenic, as well as copper, cadmium, lead, and zinc. These contaminants pose potential risks to human health, life in nearby streams, and plants and animals in adjacent lands over 300 square miles. In addition to the millions of cubic yards of tailings, furnace slag, flue dust, and square miles of soil contaminated by airborne wastes, millions of gallons of groundwater have been polluted from wastes and soils. Arsenic and copper are the primary contaminants of concern (COC) and drive remediation activities (U.S. Environmental Protection Agency 2014).

During the nearly 100-year operation of ore-processing facilities at Anaconda, Montana, the Warm Springs Creek watershed received large volumes of wastes, including slag, tailings, and contaminated soil. As a result, the Anaconda Co. Smelter and adjacent contaminated areas, including large portions of the Warm Springs Creek watershed, was listed on the Superfund National Priorities List on September 8, 1983. Despite the positive effects of extensive remediation efforts over the past 30 years, COC continue to provide a chronic impact to water quality in the creek and may periodically cause acute impacts when the creek meanders and contaminated stream banks erode. Bank erosion is primarily due to human actions which have resulted in reaches of the channel being unstable with increasing lateral movement and down cutting (CDM 1999).

The final design for the RDU 10 Warm Springs Creek project requires removal of wastes and soil/waste mixtures containing elevated concentrations of COC where they are likely causing metals loading to the stream. Wastes removed from Warm Springs Creek and vicinity would be transported to the Opportunity Ponds Waste Management Area for disposal. Removal areas would be backfilled with clean fill and soil when necessary. Streams would be realigned into abandoned channels or newly constructed channels, and stream banks would be stabilized with appropriate riparian vegetation according to best management practices (BMPs). These streambank remediation techniques are considered soft engineering approaches. The stream would be further protected by implementing institutional controls such as grazing restrictions or other land use restrictions, and future monitoring and maintenance of the stream and project areas (CDM Smith 2012).

The RDU 10 remedial design is intended to remediate Warm Springs Creek such that stream water quality meets the 2011 Anaconda Regional Water, Waste, and Soils Operable Unit Record of Decisions performance standards (CDM Smith 2012). As discussed in the Warm Springs Creek Final Design Report (CDM Smith 2012), water quality studies identified reaches where unstable banks or fluvial waste deposits in the floodplain cause significant increases in total recoverable copper concentrations. The four most significant reaches of copper loading in order of importance are (see Figure 2-12 in U.S. Environmental Protection Agency 2014): 1) the reach between stations WS-4D and WS-5; 2) the reach between stations WS-4C and WS-4D; 3) the Reach between stations WS-4B and WS-4A; and 4) the reach between stations WS-3 and WS-4. The proposed action includes efforts in two of these reaches, WS-3 and WS-4, (a.k.a., Section 32) and WS-4D and W-S5 (a.k.a., Lower Warm Springs). As such, the proposed action consists of two distinct project areas where the majority of ground disturbing activities and instream work will occur, Lower Warm Springs Creek and Section 32 (see Figure 2-2 in U.S. Environmental Protection Agency 2014 p. 2-3).

The Warm Springs Creek project area is located east of Anaconda, Montana, east of Galen Road, and parallel the area north of Highway 48 to its entry onto the 100-year floodplain of the Clark Fork River. The Section 32 project area extends from Galen Road to the Anaconda-Deer Lodge County airport. The density of vegetation within this area is variable, with upland portions of the floodplain being sparsely vegetated, and vegetation more abundant in areas close to the stream channel. The

Lower Warm Springs Creek project area is located primarily on the Gochanour and Johnson Ranches east of the airport. Although the soils in the Section 32 project area contain elevated concentrations of COCs, the project area is well-vegetated due to sub-irrigation from the shallow ground water table.

The reach of stream between the two project areas (denoted above as the reach between stations WS-4B and WS-4A) is well vegetated and stable. The source of metals loading in the reach has not been identified. The reach is located within the Yellow Gopher cultural resource area. Consequently, there is a preference to limit the removal of contaminants to preserve the cultural resource. Remedial activities have been postponed in the area until after the proposed action has been implemented. EPA anticipates that as a result of the proposed action, no additional efforts will be needed. Postponement will result in preservation of existing vegetation and relatively stable stream banks in Reach 5 (Figure 2-12) (CDM Smith 2012). The proposed Remedial Actions (RA) conducted in the two project areas are expected to achieve the surface water quality performance standards. Note that additional RAs in the vicinity of Warm Springs Creek, including remediation of parcels near the former Arbiter Plant under the Old Works OU and remediation of LRES polygons east of Galen Road under the RDU 7 RA, are expected to reduce COC loading to Warm Springs Creek through a reduction in surficial COC concentrations and establishment of vegetation.

Section 32 Project Area: Specific remedial action objectives include, minimizing source contamination to surface waters that would result in exceeding of State of Montana water quality standards and returning surface water to its beneficial use by reducing loading sources of COC. Non-vegetated and unstable banks in Section 32 require remediation as copper loading increases in this reach. Upstream of Section 32, the surface water meets the State of Montana DEQ surface water criteria; however, Section 32 and all reaches downstream exceed the aquatic criteria during high flow conditions.

The proposed activities in the Section 32 project area include (see Figures 2-2, 2-3, 2-4, and 2-5 in U.S. Environmental Protection Agency 2014):

1. installation of one temporary stream crossing;

2. installation of four lateral Flow Control Berms (see Figures 2-4 and 2-5 in U.S. Environmental Protection Agency 2014);

3. channel reconstruction (see Figure 2-5 in U.S. Environmental Protection Agency 2014);

4. reactivation of the historical channel through the alluvial fan area with a capacity of approximately the two years storm event (405 cubic feet per second). Specific items included in the reactivation include:

    - removal of debris and surface fine sediments to a depth of 6 to 24 inches
    - processing of the excavated material
    - saving of cobbles and other clean, native substrates
    - placing of native substrate into the reconstructed channel in a composition similar to that documented in pebble counts; and

5. removal of the existing berm (otherwise known as the "Nike" berm) that is currently located between the north and south channels and on the island of Section 32 (see Figure 2-4 in U.S. Environmental Protection Agency 2014).

The purpose of Section 32 remediation is to remove contaminated sediments and create a clean, stable channel and a broad floodplain that the stream can access during 5-year flood events. Where a defined stream bank exists, remediation activities aim to protect the existing bank. For degraded banks, remediation activities would ensure that reconstructed banks tie-in to the existing grade of the defined bank.

No in-stream work would occur below the braided section of the Section 32 project area; however, removal of contaminants would occur in spot locations no closer than 20 feet from the top of the bank. No remedial activities are planned between the confluence of the north and south channels and the airport road bridge.

The removal of material from Section 32 includes areas with visible tailings and high concentrations of contaminants, the debris jam (i.e., fence, woody debris), the existing berm, and the depositional area (see Figures 2-4 and 2-5 in U.S. Environmental Protection Agency 2014). The proposed action will also alter the existing 100 year floodplain. Areas south of Highway 48 and adjacent to the airport would no longer be considered within the 100 year floodplain. More water would be available within the main channel of Warm Springs Creek. The changes in the floodplain as a result of the proposed action are depicted on Figure 2-6 in U.S. Environmental Protection Agency 2014.

Lower Warm Springs Creek Project Area: Activities in Lower Warm Springs Creek project area are focused primarily on the removal of fluvially-deposited waste materials with elevated COCs and reactivation of a historic channel. The proposed design for Lower Warm Springs Creek incorporates a number of actions including:

1. installation of three to five temporary stream crossings. All temporary stream crossings will provide fish passage for sub-adult and adult bull trout (see Appendix A);

2. removal of visible tailings (TYP) (see Figures 2-7 and 2-8 in U.S. Environmental Protection Agency 2014);

3. channel reconstruction and corridor remediation (see Figures 2-7 through 2-11 in U.S. Environmental Protection Agency 2014);

4. bank stabilization and corridor remediation (see Figures 2-7 and 2-8 in U.S. Environmental Protection Agency 2014);

5. grazing management, select removal, and bank stabilization (see Figures 2-7 and 2-8 in U.S. Environmental Protection Agency 2014). Specific items include:

    - removal of concentrations above cleanup levels within the Channel Migration Zone (CMZ)
    - reconstruction of the historic channel (Gochanour Property)
    - stabilization of eroding banks

- plugging of an abandoned channel to create stock pond/wetlands
- grazing / agriculture management
- beaver management

Within the Lower Warm Springs Creek Project Area, the first 1,700-foot upstream section includes minimal remedial activity with little impact to the existing channel and vegetation. Contaminant removal activities increase moving downstream. Contaminant removal involves preserving a 5-foot wide section of existing bank closest to the channel and removing the contaminated soils located behind this section. This removal technique is used to prevent significant quantities of sediment from entering the stream. The top 12 to 24 inches of contaminated soils are expected to be removed.

One of the primary goals of the remedial actions is to restore flow to the historic, abandoned stream channel. Remedial activities planned for the historic channel include streambed excavation, bank stabilization, and vegetation removal, which will result in a new channel. Flow would be restored by plugging the existing channel with clean, native material thereby diverting flow into the historic channel. The existing channel would become an off-channel oxbow or wetland area with an estimated 1 to 2 feet of standing water. It would likely hold surface water continually due to groundwater inputs and water from the new channel during flood events. This off-channel backwater would increase the storage capacity of the system and provide off-channel wildlife habitat.

A secondary goal of the remedial actions described above is to establish floodplain connectivity for 2-year flood events throughout the Lower Warm Springs Creek project area, where possible. For areas that already have 2-year connectivity, contaminated soils will be removed and they will be returned to existing grade. For areas that are more disconnected from the floodplain, contaminated soils will be removed and areas will be graded down to establish 2-year connectivity. Where this is infeasible, a 5- to10-foot wide terrace with 2-year connectivity will be constructed.

Transport and Disposal

Excavated wastes and soil/waste mixtures will be transported to the Opportunity Ponds Waste Management Area (WMA) for disposal (Figures 2-4 and 2-9). Because the excavated materials must cross a public road (Highway 48), the Remedial Action Work Plan (RAWP) contains a Transportation Plan to be approved by the Montana Department of Transportation and the Anaconda-Deer Lodge County road department (Atlantic Richfield 2013). The excavated wastes will be transported for disposal to the B2.12 cell of the Opportunity Ponds Waste Management Area or other approved locations. The RAWP includes a Disposal Plan that conforms to the requirements set forth in Atlantic Richfield's B2.12 Waste Repository Plan (Atlantic Richfield 2013).

In order to limit and minimize potential impacts to aquatic resources the following conservation measures and BMPs will be implemented as needed (CDM Smith 2014):

1. Avoid and minimize impacts to streambanks during removal and in-situ activities and during planting to prevent bank destabilization. A minimum 5-foot wide native buffer is to be maintained along the streambanks. Maintenance of the "buffer strip" will provide protection against runoff from the excavation area toward the stream and also provide channel stability and protection of the excavation areas should unexpected high flow conditions associated with short-

term storm events occur within Warm Springs Creek. The native buffer will become a temporary high point between the excavated floodplain and the receiving water and will therefore serve to prevent uncontrolled runoff from entering the stream. Portions of the 5-foot native buffer will be removed during the construction of stream bank stabilization measures. Removal of the native buffer is to be performed in small portions and immediately followed by the installation of streambank treatments. Removal of soils within the 5-foot buffer is to be completed using equipment that prevents side casting of materials into Warm Springs Creek, such as an excavator (Atlantic Richfield 2013).

2. Minimize re-contamination of the site by starting construction in Section 32 and working downstream.

3. Toe material harvested on site will be of similar size and shape as rock typically found in the streambanks and bed material. This allows for current aquatic and benthic habitats to be reestablished faster.

4. Native desirable woody vegetation will not be disturbed during construction activities to the maximum extent possible. Haul roads and staging areas will be limited in extent and located so as to minimize disturbance of existing vegetation. Staging areas will be located outside of riparian areas.

5. Construction activities will be performed in a manner to minimize discharges into Warm Springs Creek to the maximum extent practicable. In addition to those conditions outlined in construction stormwater permits, BMPs will be employed to manage stormwater runoff and reduce water quality degradation during and after construction. All remediated lands will be protected to allow for adequate establishment and growth of new vegetation. Land owner agreements will be secured to ensure proper land management.

6. Bank treatments will be designed to be deformable at and above the selected design discharge for bank deformability. Below the design discharge, bank toes and upper banks will be designed for non-deformability.

7. Unnecessary removal of toe material will potentially destabilize banks and result in sediment loading downstream. Care will be taken to remove only contaminated toe material, and to minimize sediment loading in the creek to the maximum extent possible. When possible, reconstructed streambanks will be installed in dry conditions through strategic project staging, flow diversions, and flow deflection.

8. Vegetation will be planted in contact with the low water table or the capillary fringe at base flow to encourage survival, rapid growth, and effective bank reinforcement.

9. Construction activities will be scheduled to minimize impacts to aquatic life and wildlife.

10. Streambanks that failed or were damaged during a large runoff event will be repaired or replaced as soon as possible.

11. Fencing will be installed to limit cattle grazing.

12. Turbidity Controls: In order to achieve project objectives, some work must be performed within the immediate proximity to the stream channel under flowing conditions with the potential to release sediments into the active watercourse. The following construction BMPs will be implemented for work along Warm Springs Creek or its tributary channels to reduce sediment loading and excessive turbidity:

    - A vegetative buffer strip of native soil/vegetation may be left along the channel at select locations during the major floodplain stripping activities;
    - Removal of tailings/impacted soils from streambanks will be completed using excavators (or similar equipment) to prevent side-casting of materials into Warm Springs Creek, and equipment will generally be required to track perpendicularly to the streambanks to prevent bank collapse or equipment falling into the stream;
    - Excavation within streambanks will be followed as soon as possible by the installation of streambank treatments to minimize the period of instability;
    - All streambank work will be done during periods of low flow;
    - Clear water diversions, cofferdams, and/or pumping may be necessary to isolate or dewater some streambank treatment sites depending on the extent of contaminants or erosion encountered; and
    - No dewatering effluent will be discharged into Warm Springs Creek until visually free of sediments; and temporary channel crossings will be constructed for equipment access and no heavy equipment shall be allowed to enter the active stream channel.

13. Stormwater Management: Temporary construction BMPs for stormwater management are described in detail in the Storm Water Pollution Prevention Plan (SWPPP) provided as Appendix D of the RAWP (Atlantic Richfield 2013). The purpose of the SWPPP is to ensure that the substantive requirements of the Montana General Permit for Storm Water Discharges Associated with Construction Activity are met during the RA construction activities. During site work activities, standard BMPs shall be followed/installed, as appropriate, to divert stormwater around the work area, minimize off-site sediment tracking, and to prevent stormwater runoff from transporting sediments and/or pollutants (e.g., construction related oils, fuels, and other materials) down-gradient into Warm Springs Creek or adjacent wetlands. These measures may include, but are not limited to, vegetative buffer strips, stabilized construction entrances, silt fence, straw wattles, rock outlets, wetland barriers, and good housekeeping practices (Atlantic Richfield 2013).

14. Institutional Controls: The Final ICMP in conjunction with the selected reclamation and engineering controls will include three basic components: land use restrictions and zoning, groundwater controls, and public notices or advisories (Atlantic Richfield 2013).

15. Grazing Management: Grazing restrictions are planned for the near stream corridor throughout the entire length of Lower Warm Springs Creek (pending Landowner Agreement coordination). Per Section 4.2 of the RAWP, structural barriers (i.e., wire fence) are planned to be constructed around remediated floodplain areas and streambanks for the purpose of prohibiting livestock access and preventing negative land use impacts to the remedy. Fencing would remain in place until performance standards for all components of the remedy have been attained (typically a period of 5 years for revegetation). Access to Warm Springs Creek for the purpose of livestock

watering during periods of remedy establishment may be provided by means of fenced and stabilized stream access points (water gaps) to be constructed as a component of the RA. Similar grazing restrictions may be employed for the portion of the project area currently owned by Atlantic Richfield if grazing within that parcel is to be permitted or is anticipated. Limiting grazing within the riparian corridor during the interim establishment period will allow the system to recover if hydric soils have not been lost due to extensive soil compaction and if there are existing populations of herbaceous native species (sedge, rush and native grasses) that possess rhizomatous root systems capable of recolonizing on disturbed soils (TREC 2014).

16. Monitoring Plans: Monitoring would commence immediately following construction completion and is expected to be ongoing for anywhere between 5-10 years depending on the system's response. Monitoring emphasis is placed on assessing bank stability (i.e., assess bank toes and fabric, short-term/long-term willow density, canopy cover, etc.) and evaluating establishment of vegetative cover (i.e., vegetation canopy cover, woody density, etc). Additional monitoring specific to bull trout or bull trout habitat conditions (i.e., water temperature, pool variability, in-stream structure) are not planned at this time.

17. Restricted Land Use: During and after construction, landowners will be required to manage the remediated areas as required in the Final Institutional Control Management Plan (ICMP) and the owner's agreement with ARCO. Access to the banks will be limited until vegetation is established.

18. Work in the historic channel and existing channel will be conducted in dry conditions. This reduces sediment loading and expedites construction activities, which consequently reduces the time stream flows need to be diverted.

19. Materials removed from the channel will be reused when possible (i.e., woody debris will be placed in the floodplain to increase microtopography and create habitat). Channel bed material will be cleaned and reused in areas that require backfill.

20. Project oversight personnel will coordinate with the contractor to minimize the number of temporary stream crossings to be installed and limit the timeframes in which the crossings will remain within the channel. Oversight of the installation and removal of the temporary crossings will help to minimize the impact to riparian vegetation and stream bed material. Upon installation, flow conditions will be observed and large cobble bed material will be selectively placed to create backwater conditions to further reduce culvert outlet velocities, if necessary (TREC 2014).

21. Traffic to and from the "island" in Section 32 will be limited due to the reuse of materials and due to the fact that only one creek crossing is currently being proposed.

In addition to the conservation measures and BMPs listed above, a plan should be devised and implemented prior to construction that instructs construction personnel on courses of action should bull trout be observed or encountered. This plan should involve immediately stopping activities that could result in harm or harassment to bull trout and U.S. Fish and Wildlife Service should be notified. In cases where the bull trout has become entrapped, a Catch and Transport Plan (Appendix

A.) will be implemented for the remove of bull trout out of impoundments or active construction areas.

Monitoring

The design presented in the BA represents a partial removal; therefore, surface water performance and compliance monitoring would be required. Conceptually, stream water quality samples would be collected eight times per year at U.S. Geological Station monitoring station 12323770 (i.e., Anaconda Regional Water, Waste, and Soils Operable Unit (ARWW&S OU)(Atlantic Richfield Company, 2012) sampling station WSC-6). Samples would be collected during high and low flows, but would focus on the high flow period. If elevated concentrations of COCs are detected under this monitoring program, the stream would be re-evaluated and additional monitoring or contingency remedies may be required. Final surface water monitoring and maintenance requirements would be established under separate site-wide monitoring and maintenance plans (CDM Smith 2012).

Turbidity monitoring, similar to the program used during the Milltown Dam removal, should be conducted during RA construction in the stream corridor to ensure that BMPs designed to minimize sediment transports to the stream are functioning properly. Protocols for inspection and maintenance would be set forth in a final Inspection and Maintenance Plan, to be developed after RA construction is completed.

The proposed action includes the vegetation monitoring plan described in section 8.0 of the RAWP in Atlantic Richfield 2013. Vegetation monitoring will have a short-term and a long-term component. The purpose of the short-term or qualitative monitoring across all the treated streambanks and wetlands is to determine the initial success of the seeding and planting efforts in the first 3 years following seeding. Long-term or quantitative monitoring assesses the development of the riparian plant community from which the permanence of vegetation stands can be evaluated.

III. Analytical Framework for the Jeopardy and Adverse Modification Analysis

Jeopardy Determination: In accordance with policy and regulation, the jeopardy analysis in this BO relies on four components: (1) the *Status of the Species*, which evaluates the bull trout's range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the bull trout in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the bull trout; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the bull trout; and (4) *Cumulative Effects*, which evaluates the effects of future, non-federal activities in the action area on the bull trout.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed federal action in the context of the bull trout's current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the bull trout in the wild.

Interim Recovery Units (IRU) was defined in the final listing rule for the bull trout for use in completing jeopardy analyses. Pursuant to Service policy, when an action impairs or precludes the capacity of an IRU from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, the BO describes how the action affects not only the capability of the IRU, but the relationship of the recovery unit to both the survival and recovery of the listed species as a whole.

The jeopardy analysis for the bull trout in this BO uses the above approach and considers the relationship of the action area and core area (discussed below under the *Status of the Species* section) to the IRU and the relationship of the IRU to both the survival and recovery of the bull trout as a whole as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Within the context of the jeopardy analytical framework (Table 2), the Service uses the hierarchal relationship between units of analysis (i.e., the geographical subdivisions of local populations, core areas, management units and interim recovery units) defined in the draft Recovery Plan to characterize effects of the proposed action beginning at the lowest level or smallest scale (local population) and then progresses toward the highest level or largest scale (Interim Recovery Unit). The hierarchal relationship between units of analysis is used to determine whether the proposed action is likely to jeopardize the survival and recovery of bull trout. Should the adverse effects of the proposed action not rise to a level that would appreciably reduce survival and recovery of the species at a lower scale, such as the local or the core population scales, by deduction the proposed action would not jeopardize bull trout at the higher scale of the coterminous United States (i.e. range-wide). Therefore, the determination would result in a no-jeopardy finding. However, should a proposed action produce adverse effects that appreciably reduce survival and recovery of the species at a lower scale of analysis, then further analysis is warranted at the next higher scale. Generally, if a proposed federal action is incompatible with the viability of the affected core area population(s), inclusive of associated habitat conditions, a jeopardy finding is considered to be warranted because of the relationship of each core area population to the survival and recovery of the species has a whole (70 CFR 56258).

Survival is defined as for determination of jeopardy/adverse modification: the species' persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter (U.S. Fish and Wildlife Service 1998b p. 22). Recovery is defined as improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Act. [50 CFR §402.02].

For the purposes of bull trout recovery, emphasis is placed on the adult (migratory) life history forms at the core area scale. Benefits of migratory bull trout include greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Rieman and McIntyre 1993, MBTSG 1998, Frissell 1999). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbance makes local habitats temporarily unsuitable, the range of the species is diminished, and the potential for enhanced reproductive capabilities are lost (Rieman and McIntyre 1993).

Adverse Modification Determination: This BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

The adverse modification analysis in this BO relies on four components: (1) the *Status of Critical Habitat*, which evaluates the range-wide condition of designated critical habitat for the bull trout in terms of primary constituent elements (PCEs); the factors responsible for that condition and the intended recovery function of the critical habitat overall; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units or subunits; and (4) *Cumulative Effects*, which evaluates the effects of future, non-federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed federal action on bull trout critical habitat are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the bull trout.

The analysis in this BO places an emphasis on using the intended range-wide recovery function of bull trout critical habitat, especially in terms of maintaining and/or restoring viable core areas, and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

The scales of analysis are described below in tables 3 and 4. The scales of analysis for jeopardy from smallest to largest are as follows: local population, core area, management unit, and IRU for the purposes of consultation and recovery. The core area scale is an appropriate unit of analysis by which threats to bull trout and recovery should be measured (FR 70, No 185). Similarly the geographical scales for critical habitat from smallest to largest are as follows: stream segment or water body, critical habitat subunit (CHSU), critical habitat unit (CHU) and the range of bull trout. Generally in the Clark Fork Management Unit (MU), bull trout core areas are similar in geographical scale to the bull trout critical habitat unit (CHSU).

The proposed action will affect the Upper Clark Fork River core area and Upper Clark Fork River CHSU. For the purposes of this BO, all designated critical habitat supports and is occupied by a local population. The portion of Warm Springs Creek in the action area provides Foraging Overwintering and Migratory (FMO) habitat for bull trout and was designated as critical habitat because of its potential to contribute to bull trout recovery. For analysis purposes, the relationship of the Warm Springs Creek to the larger population scales is illustrated in Tables 1 and 2 below.

Table 1. Hierarchy of units of analysis for bull trout jeopardy analysis for this BO. Local populations affected by the proposed action are italicized.

Name/Units of scale	Hierarchical Relationship
Coterminous United States	Range of bull trout
Columbia River Interim Recovery Unit/DPS (IRU)	One of 5 Interim Recovery Units in the range of the species within the coterminous United States.
Clark Fork Management Unit (MU)	One of 22 Management Units in the Columbia River IRU/DPS
Upper Clark Fork River Core Area	One of the 35 core areas within the Clark Fork Management Unit.
Upper Clark Fork River Core Area	
Local Populations: *Warm Springs Creek*, Flint Creek, Boulder Creek, Harvey Creek, Little Blackfoot River*, Racetrack Creek* (* were not designated as critical habitat)	

In the Clark Fork Management Unit (MU), a distinction has been made between two types of core areas (primary and secondary) based on the size, connectedness, and complexity of the associated watershed, and the degree of natural population isolation. The draft Recovery Plan identifies the Upper Clark Fork River Complex as a primary core area that includes both the Middle Clark Fork River and Upper Clark Fork River core area (U.S. Fish and Wildlife Service 2002b, pp. 131-132). The loss of a primary core area would represent a significant gap in the range of the species within this MU. The following have been designated as primary core areas under recovered conditions in the Clark Fork MU: the Upper Clark Fork River Complex, Rock Creek, Blackfoot River, Bitterroot River, Lower Clark Fork River, Lake Pend Oreille, Priest Lakes and Priest River, Flathead Lake, Swan Lake, and Hungry Horse Reservoir.

Table 2. Hierarchy of units of analysis for bull trout adverse modification analysis for this BO. Critical habitat segments affected by the proposed action are italicized.

Name/Units of Scale	Hierarchical Relationship
Coterminous United States	Range of bull trout/Critical Habitat 32 Units
Clark Fork River Basin Critical Habitat Unit (CHU) 31	One of 32 Units, defined as essential for the survival and recovery of the species across the range of the species. Based on the seven guiding principles for the conservation (U.S. Fish and Wildlife Service 2009a p. 1-3).
Upper Clark Fork River Critical Habitat Subunit (CHSU) (i.e., Upper Clark Fork River Core Area)	One of 11 Subunits within the Clark Fork Basin Unit. This subunit is essential for conservation of the species as one of the several occupied major watershed in the Clark Fork Basin Critical Habitat Unit.
Designated Stream Segments and Water Bodies: Clark Fork River, *Warm Springs Creek* (Barker Creek, Foster Creek, Twin Lakes Creek, Storm Lake Creek), Flint	These water bodies contain the habitats that support local populations that in turn support the conservation of the species for this CHSU, CHU, core area, and Interim Management Unit.

Name/Units of Scale	Hierarchical Relationship
Creek, Boulder Creek, and Harvey Creek.	

The Service determined that each of the 32 individual CHUs and 99 CHSUs are essential for the conservation of the species (U.S. Fish and Wildlife Service 2009a, p. 9). The Clark Fork River Basin CHU is essential for maintaining bull trout distribution within the unique geographic region of the draft Columbia Headwaters Recovery Unit (see page 63927 of FR 75, No. 200) in large part because it represents the evolutionary heart of the migratory adfluvial bull trout life history form (U.S. Fish and Wildlife Service 2009a, p. 32). The Upper Clark Fork River CHSU and the stream segments (described in Table 2) provide habitats for spawning and rearing (SR) and foraging, migrating and overwintering (FMO) habitat essential for the conservation of the Clark Fork Basin CHU (U.S. Fish and Wildlife Service 2009a, p. 34; U.S. Fish and Wildlife Service 2009b, p. 22).

The Upper Clark Fork River CHSU is essential to bull trout conservation because it is the uppermost extension of the migratory habitat for bull trout originating in Lake Pend Oreille or the downstream portions of the Clark Fork River. Bull trout population levels are depressed and the habitat is fragmented due mostly to impacts from past land and water use activities. As a result, recovery potential may be limited, but some strongholds remain (e.g., Flint Creek and Warm Springs Creek headwaters) and it's important to secure these strongholds to sustain the genetic attributes those populations may represent. Long-term protection of water quality and quantity, especially satisfactory thermal conditions, are amongst the most important elements of the recovery strategy in the upper Clark Fork River corridor. Recovery is especially relevant given the marginal summer thermal maxima largely unsuitable for bull trout that are frequently recorded in this CHSU (U.S. Fish and Wildlife Service 2009a, p.33).

IV. Status of the Species and Critical Habitat

This section presents information about the regulatory, biological, and ecological status of bull trout that provides context for evaluating the significance of probable effects caused by the proposed action.

A. Status of the Species

A.1 Listing Status

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon, the Jarbidge River in Nevada, north to various coastal rivers of Washington to the Puget Sound, east throughout major rivers within the Columbia River Basin to the St. Mary-Belly River, and east of the Continental Divide in northwestern Montana (Cavender 1978, pp. 165-166; Bond 1992, p. 4; Brewin and Brewin 1997, pp. 209-216; Leary and Allendorf 1997, pp. 715-720). The Service completed a 5-year Review in 2008 and concluded that the bull trout should remain listed as threatened (Fish and Wildlife Service 2008, p. 53).

The bull trout was initially listed as three Distinct Population Segments (DPSs) (63 FR 31647, 64 FR 17110). The preamble to the final listing rule for the United States coterminous population of the bull trout discusses the consolidation of these DPSs, plus two other population segments, into one listed taxon and the application of the jeopardy standard under section 7 of the Act relative to this species (64 FR 58930):

"Although this rule consolidates the five bull trout DPSs into one listed taxon, based on conformance with the DPS policy for purposes of consultation under section 7 of the Act, we intend to retain recognition of each DPS in light of available scientific information relating to their uniqueness and significance. Under this approach, these DPSs will be treated as IRUs with respect to application of the jeopardy standard until an approved recovery plan is developed. Formal establishment of bull trout recovery units will occur during the recovery planning process."

Consideration of the above recovery units for purposes of the jeopardy analysis is done within the context of making the jeopardy determination at the scale of the entire listed species in accordance with Service policy (Fish and Wildlife Service 2006, pp. 1-2).

Though wide ranging in parts of Oregon, Washington, Idaho, and Montana, bull trout in the interior Columbia River basin presently occur in only about 45 percent of the historical range (Quigley and Arbelbide 1997, p. 1177; Rieman et al. 1997, p. 1119). Declining trends due to the combined effects of habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment into diversion channels and dams, and introduced non-native species (e.g., brook trout, *Salvelinus fontinalis*) have resulted in declines in range-wide bull trout distribution and abundance (Bond 1992, p. 4; Schill 1992, p. 40; Thomas 1992, pp. 9-12; Ziller 1992, p. 28; Rieman and McIntyre 1993, pp. 1-18; Newton and Pribyl 1994, pp. 2, 4, 8-9; Idaho Department of Fish and Game in litt. 1995, pp. 1-3). Several local extirpations have been reported, beginning in the 1950s (Rode 1990, p. 1; Ratliff and Howell 1992, pp. 12-14; Donald and Alger 1993, p. 245; Goetz 1994, p. 1; Newton and Pribyl 1994, p. 2; Berg and Priest 1995, pp. 1-45; Light et al. 1996, pp. 20-38; Buchanan and Gregory 1997, p. 120).

Land and water management activities such as dams and other diversion structures, forest management practices, livestock grazing, agriculture, road construction and maintenance, mining, and urban and rural development continue to degrade bull trout habitat and depress bull trout populations (Fish and Wildlife Service 2002a, p. 13).

A.2 Species Description

Bull trout (*Salvelinus confluentus*), member of the family Salmonidae, are char native to the Pacific Northwest and western Canada. The bull trout and the closely related Dolly Varden (*Salvelinus malma*) were not officially recognized as separate species until 1980 (Robins et al. 1980, p. 19). Bull trout historically occurred in major river drainages in the Pacific Northwest from the southern limits in the McCloud River in northern California (now extirpated), Klamath River basin of south central Oregon, and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, p. 165-169; Bond 1992, p. 2-3). To the west, the bull trout's current range includes Puget Sound, coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2-3). East of the Continental Divide bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and

British Columbia (Cavender 1978, p. 165-169; Brewin and Brewin 1997, pp. 209-216). Bull trout are widespread throughout the Columbia River basin, including its headwaters in Montana and Canada.

A.3 Life History

Bull trout exhibit resident and migratory life history strategies throughout much of the current range (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the streams where they spawn and rear. Migratory bull trout spawn and rear in streams for one to four years before migrating to either a lake (adfluvial), river (fluvial), or, in certain coastal areas, to saltwater (anadromous) where they reach maturity (Fraley and 1989, p. 1; Goetz 1989, pp. 15-16). Resident and migratory forms often occur together and it is suspected that individual bull trout may give rise to offspring exhibiting both resident and migratory behavior (Rieman and McIntyre 1993, p. 2).

Bull trout have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993, p. 4). Watson and Hillman (1997, p. 248) concluded that watersheds must have specific physical characteristics to provide habitat requirements for bull trout to successfully spawn and rear. It was also concluded that these characteristics are not necessarily ubiquitous throughout these watersheds resulting in patchy distributions even in pristine habitats.

Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the range (Fraley and Shepard 1989, pp. 135-137; Rieman and McIntyre 1993, p. 2 and 1995, p. 288; Buchanan and Gregory 1997, pp. 121-122; Rieman et al. 1997, p. 1114). Water temperature above 15°C (59°F) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, p. 133; Rieman and McIntyre 1995, pp. 255-296). Spawning areas are often associated with cold water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1117). Goetz (1989, pp. 22, 24) suggested optimum water temperatures for rearing of less than 10°C (50°F) and optimum water temperatures for egg incubation of 2 to 4°C (35 to 39°F).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Goetz 1989, pp. 22-25; Pratt 1992, p. 6; Thomas 1992, pp. 4-5; Rich 1996, pp. 35-38; Sexauer and James 1997, pp. 367-369; Watson and Hillman 1997, pp. 247-249). Jakober (1995, p. 42) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Lolo River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Bull trout prefer relatively stable channel and water flow conditions (Rieman and McIntyre 1993, p. 6). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, pp. 368-369).

The size and age of bull trout at maturity depend upon life history strategy. Growth of resident fish is generally slower than migratory fish; resident fish tend to be smaller at maturity and less fecund (Goetz 1989, p. 15). Bull trout normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Bull trout are iteroparous (they spawn more than once in a lifetime), and both repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982, p. 95; Fraley and Shepard 1989, p. 135; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Migratory bull trout frequently begin spawning migrations as early as April, and have been known to move upstream as far as 250 kilometers (km) (155 miles (mi)) to spawning grounds (Fraley and Shepard 1989, p. 135). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p. 1) and, after hatching, juveniles remain in the substrate. Time from egg deposition to emergence may exceed 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992, p. 1).

The iteroparous reproductive system of bull trout has important repercussions for the management of this species. Bull trout require two-way passage up and downstream, not only for repeat spawning, but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous (fishes that spawn once and then die, and therefore require only one-way passage upstream) salmonids. Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route.

Bull trout are opportunistic feeders with food habits primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro zooplankton, and small fish (Boag 1987, p. 58; Goetz 1989, pp. 33-34; Donald and Alger 1993, pp. 239-243). Adult migratory bull trout are primarily piscivores, known to feed on various fish species (Fraley and Shepard 1989, p. 135; Donald and Alger 1993, p. 242).

A.4 Population Dynamics

The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002a, pp. 47-48) defined core areas as groups of partially isolated local populations of bull trout with some degree of gene flow occurring between them. Based on this definition, core areas can be considered metapopulations. A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meefe and Carroll 1994, p. 188). In theory, bull trout metapopulations (core areas) can be composed of two or more local populations, but Rieman and Allendorf (2001, p. 763) suggest that for a bull trout metapopulation to function effectively, a minimum 10 local populations are required. Bull trout core areas with fewer than five local populations are at increased risk of local extirpation, core areas with between five and 10 local populations are at intermediate risk, and core areas with more than 10 interconnected local populations are at diminished risk (Fish and Wildlife Service 2002a, pp. 50-51).

The presence of a sufficient number of adult spawners is necessary to ensure persistence of bull trout populations. In order to avoid inbreeding depression, it is estimated that a minimum of 100 spawners are required. Inbreeding can result in increased homozygosity of deleterious recessive alleles which can in turn reduce individual fitness and population viability (Whitesel et al. 2004, p. 36). For persistence in the longer term, adult spawning fish are required in sufficient numbers to reduce the deleterious effects of genetic drift and maintain genetic variation. For bull trout, Rieman and Allendorf (2001, p. 762) estimate that approximately 1,000 spawning adults within any bull trout population are necessary for maintaining genetic variation indefinitely. Many local bull trout populations individually do not support 1,000 spawners, but this threshold may be met by the presence of smaller interconnected local populations within a core area.

For bull trout populations to remain viable (and recover), natural productivity should be sufficient for the populations to replace themselves from generation to generation. A population that consistently fails to replace itself is at an increased risk of extinction. Since estimates of population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an indicator of a spawning adult population. The direction and magnitude of a trend in an index can be used as a surrogate for growth rate.

Survival of bull trout populations is also dependent upon connectivity among local populations. Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution even in pristine habitats (Rieman and McIntyre 1993, p. 7). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991, p. 22). Burkey (1989, p. 76) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth of local populations may be low and probability of extinction high. Migrations also facilitate gene flow among local populations because individuals from different local populations interbreed when some stray and return to non natal streams. Local populations that are extirpated by catastrophic events may also become reestablished in this manner.

In summary, based on the works of Rieman and McIntyre (1993, pp. 9-15) and Rieman and Allendorf (2001, pp 756-763), the draft bull trout Recovery Plan identified four elements to consider when assessing long-term viability (extinction risk) of bull trout populations: (1) number of local populations, (2) adult abundance (defined as the number of spawning fish present in a core area in a given year), (3) productivity, or the reproductive rate of the population, and (4) connectivity (as represented by the migratory life history form).

A.5 Status and Distribution

As noted above, in recognition of available scientific information relating to their uniqueness and significance, five population segments of the coterminous United States population of the bull trout are referred to as IRUs and considered essential to the survival and recovery of this species and are identified as: (1) Jarbidge River, (2) Klamath River, (3) Coastal-Puget Sound, (4) St. Mary-Belly River, and (5) Columbia River. Each of these IRUs is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

A summary of the current status and conservation needs of the bull trout within these IRUs is provided below. A comprehensive discussion of these topics is found in the draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002a, entire; 2004a, b; entire).

Central to the survival and recovery of the bull trout is the maintenance of viable core areas (Fish and Wildlife Service 2002a, p. 54). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat, and in some cases their use of spawning habitat. Each of the population segments listed below consists of one or more core areas. One hundred and twenty one core areas are recognized across the United States range of the bull trout (U.S. Fish and Wildlife Service 2008, p. 21).

A core area assessment conducted by the Service for the five year bull trout status review determined that of the 121 core areas comprising the coterminous listing, 43 are at high risk of extirpation, 44 are at risk, 28 are at potential risk, four are at low risk and two are of unknown status (U.S. Fish and Wildlife Service 2008, p. 29).

Jarbidge River IRU: This IRU currently contains a single core area with six local populations. Less than 500 resident and migratory adult bull trout, representing about 50 to 125 spawners, are estimated to occur within the core area. The current condition of the bull trout in this segment is attributed to the effects of livestock grazing, roads, angler harvest, timber harvest, and the introduction of non-native fishes (Fish and Wildlife Service 2004a, p. iii). The draft bull trout Recovery Plan identifies the following conservation needs for this segment: (1) maintain the current distribution of the bull trout within the core area, (2) maintain stable or increasing trends in abundance of both resident and migratory bull trout in the core area, (3) restore and maintain suitable habitat conditions for all life history stages and forms, and (4) conserve genetic diversity and increase natural opportunities for genetic exchange between resident and migratory forms of the bull trout. An estimated 270 to 1,000 spawning fish per year are needed to provide for the persistence and viability of the core area and to support both resident and migratory adult bull trout (Fish and Wildlife Service 2004a, p. 62-63). Currently this core area is at high risk of extirpation (Fish and Wildlife Service 2005, p. 9).

Klamath River IRU: This IRU currently contains three core areas and 12 local populations. The current abundance, distribution, and range of the bull trout in the Klamath River Basin are greatly reduced from historical levels due to habitat loss and degradation caused by reduced water quality, timber harvest, livestock grazing, water diversions, roads, and the introduction of non-native fishes. Bull trout populations in this unit face a high risk of extirpation (Fish and Wildlife Service 2002b, p. iv). The draft bull trout Recovery Plan (Fish and Wildlife Service 2002b, p. v) identifies the following conservation needs for this unit: (1) maintain the current distribution of the bull trout and restore distribution in previously occupied areas, (2) maintain stable or increasing trends in bull trout abundance, (3) restore and maintain suitable habitat conditions for all life history stages and strategies, and (4) conserve genetic diversity and provide the opportunity for genetic exchange among appropriate core area populations. Eight to 15 new local populations and an increase in population size from about 3,250 adults currently to 8,250 adults are needed to provide for the persistence and viability of the three core areas (Fish and Wildlife Service 2002d, p. vi).

Coastal-Puget Sound IRU: Bull trout in the Coastal-Puget Sound IRU exhibit anadromous, adfluvial, fluvial, and resident life history patterns. The anadromous life history form is unique to this unit. This population segment currently contains 14 core areas and 67 local populations (Fish and Wildlife Service 2004b, p. iv; 2004c, pp. iii-iv). Bull trout are distributed throughout most of the large rivers and associated tributary systems within this unit. With limited exceptions, bull trout continue to be present in nearly all major watersheds where they likely occurred historically within this unit. Generally, bull trout distribution has contracted and abundance has declined, especially in the southeastern part of the unit. The current condition of the bull trout in this population segment is attributed to the adverse effects of dams, forest management practices (e.g., timber harvest and associated road building activities), agricultural practices (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation), livestock grazing, roads, mining, urbanization, angler harvest, and the introduction of non-native species. The draft bull trout Recovery Plan (Fish and Wildlife Service 2004b, pp. ix-x) identifies the following conservation needs for this unit: (1) maintain or expand the current distribution of bull trout within existing core areas, (2) increase bull trout abundance to about 16,500 adults across all core areas, and (3) maintain or increase connectivity between local populations within each core area.

St. Mary-Belly River IRU: This IRU currently contains six core areas and nine local populations (Fish and Wildlife Service 2002c, p. v). Currently, bull trout are widely distributed in the St. Mary River drainage and occur in nearly all of the waters that were inhabited historically. Bull trout are found only in a 1.2-mile reach of the North Fork Belly River within the United States. Redd count surveys of the North Fork Belly River documented an increase from 27 redds in 1995 to 119 redds in 1999. This increase was attributed primarily to protection from angler harvest (Fish and Wildlife Service 2002c, p. 37). The current condition of the bull trout in this population segment is primarily attributed to the effects of dams, water diversions, roads, mining, and the introduction of non-native fishes (Fish and Wildlife Service 2002c, p. vi). The draft bull trout Recovery Plan (Fish and Wildlife Service 2002c, pp. v-ix) identifies the following conservation needs for this unit: (1) maintain the current distribution of the bull trout and restore distribution in previously occupied areas, (2) maintain stable or increasing trends in bull trout abundance, (3) maintain and restore suitable habitat conditions for all life history stages and forms, (4) conserve genetic diversity and provide the opportunity for genetic exchange, and (5) establish good working relations with Canadian interests because local bull trout populations in this unit are comprised mostly of migratory fish whose habitat is mainly in Canada.

Columbia River IRU: The Columbia River IRU includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Currently, following consolidation of some core areas, this IRU contains 90 of the 118 core areas across the range of bull trout. In the early 1950s, bull trout populations within this IRU were at best stable and more often declining (Thomas 1992; Schill 1992; Pratt and Huston 1993). Bull trout were estimated to have historically occupied about 60 percent of the Columbia River Basin, and in 1997, bull trout occurred in 45 percent of the estimated historical range (Quigley and Arbelbide 1997, p. 1177).

The condition of the bull trout populations within these core areas varies from poor to good, but generally all have been subject to the combined effects of habitat degradation, fragmentation, and alterations associated with one or more of the following activities: dewatering, road construction and maintenance, mining and grazing, blockage of migratory corridors by dams or other diversion structures, poor water quality, incidental angler harvest, entrainment into diversion channels, and introduced non-native species.

In 2008 as part the 5-year status review of bull trout and prior to consolidation, the Service determined that of the total 95 core areas in the Columbia River IRU population segment, 38 are at high risk of extirpation, 35 are at risk, 20 are at potential risk, two are at low risk, and two are at unknown risk (Fish and Wildlife Service 2005b, pp. 1-94).

The draft bull trout Recovery Plan (Fish and Wildlife Service 2002a, p. v) identified the following conservation needs for the Columbia River IRU: (1) maintain or expand the current distribution of the bull trout within core areas; (2) maintain stable or increasing trends in bull trout abundance; (3) maintain and restore suitable habitat conditions for all bull trout life history stages; and (4) conserve genetic diversity and provide opportunities for genetic exchange.

The draft bull trout Recovery Plan (Fish and Wildlife Service 2002a, p. 2) identified 22 recovery units within the Columbia River IRU. These units are now referred to as Management Units (MUs). MUs include groupings of bull trout with historical or current gene flow within them and were designated to place the scope of bull trout recovery on smaller spatial scales than the larger population segments.

Individual MUs are important to bull trout recovery by providing for the distribution of bull trout across their native range and maintaining adaptive ability to ensure long-term persistence. Similarly, individual core areas are the foundation of MUs, and maintenance of these areas is critical to recovery (U.S. Fish and Wildlife Service 2002a). Genetic diversity enhances long-term survival of a species by increasing the likelihood that the species is able to survive changing environmental conditions. For instance, a local population of bull trout may contain individuals with genes that enhance their ability to survive in the prevailing local environmental conditions. Individuals with a different genetic complement may persist in the local population in much lower abundance than those with locally adapted genes.

Each MU is important; and recovery units are an appropriate scale at which to gauge progress toward recovery for individual distinct population segments and the species within the coterminous United States. Recovering bull trout in each MU will maintain the overall distribution of bull trout in their native range. Conserving core areas and their habitats within recovery units should preserve genotypic and phenotypic diversity and allow bull trout access to diverse habitats. The continued survival and recovery of individual core areas is critical to the persistence of MUs and their role in the recovery of a distinct population segment (Fish and Wildlife Service 2002a, p. 54). The proposed action is located within the Clark Fork MU, which is detailed below:

Clark Fork River MU: In the Clark Fork River MU, which includes all of the Clark Fork River Basin from Albeni Falls Dam (outlet of Lake Pend Oreille) upstream to Montana headwaters, the Service described 35 core areas for bull trout. In 2002, the Service identified 152 local populations of bull trout within these core areas (U.S. Fish and Wildlife Service 2002b, p. 131). The Clark Fork River MU is among the largest and most diverse across the range of the species and contains the highest number of core areas of any MU, due in large part to the preponderance of isolated headwater lakes in the system (U.S. Fish and Wildlife Service 2002b, p. ix).

The 2008 status review applied a risk assessment model to each core area within the MU. The model used to rank the relative risk to bull trout was based on the Natural Heritage Program's NatureServe Conservation Status Assessment Criteria, which had been applied in previous assessments of fish status, including bull trout (Master et al. 2003, MNHP 2004). The model integrated four factors: population abundance, distribution, population trend, and threats (referred to as a C Rank in the model).

Results of the status review (U.S. Fish and Wildlife Service 2005b) indicated that of its 35 core areas, the Clark Fork River MU has 18 core areas rated at high risk, 5 rated as at risk and 7 at potential risk. A core area rated at high risk was functioning at "at risk" because of very limited and/or declining numbers, range, and/or habitat, making the bull trout in this core area vulnerable to extirpation (U.S. Fish and Wildlife Service 2005b). The Upper Clark Fork River core area was rated as at risk. See U.S. Fish and Wildlife Service (2005b) for a complete description of the ranking process.

The Service considers many of the core areas in the Clark Fork River MU to be at risk of extirpation due in part to natural isolation, single life-history form, and low abundance. Expansion of non-native species is the single largest human-caused threat in most of the core areas. Dams and degraded habitat have also contributed to bull trout declines across this MU.

Currently, the Service applies an analytical framework for bull trout jeopardy analyses that relies heavily on the importance of known core area populations to the species' survival and recovery. Core areas form the building blocks that provide for conservation of the bull trout's evolutionary legacy as represented by major genetic groups. The proposed action is located within the Upper Clark Fork River core area. The Upper Clark Fork River is a primary core area based on the size, connectedness, and complexity of the associated watershed and the degree of natural population isolation. The loss of a primary core area would represent a significant gap in the range of the species within this MU (U.S. Fish and Wildlife Service 2002b). The action area is located within the Upper Clark Fork River core area.

<u>Upper Clark Fork River Core Area</u>: The Upper Clark Fork River core area includes all of the Clark Fork River and all tributaries upstream of the Blackfoot River (this core area was previously described as everything upstream of Milltown Dam; however, with the removal of the dam in 2008 the new lower boundary is the Blackfoot River). Milltown Dam, constructed in 1906, had isolated bull trout populations in the Upper Clark Fork River core area from the rest of the basin for over a century. Bull trout in the Upper Clark Fork River core area probably originated historically as adfluvial spawning fish from Lake Pend Oreille in northern Idaho. Following construction of Milltown Dam, bull trout stocks in the Upper Clark Fork River core area effectively became either fluvial or resident.

In 2002, the Upper Clark Fork River core area was supported by 6 local populations (Racetrack Creek, Little Blackfoot River, Harvey Creek, Boulder Creek, Flint Creek, and Warm Springs Creek). Bull trout spawning in Flint Creek has not been documented. However, since 2002 Racetrack Creek and the Little Blackfoot River have been reclassified and are no longer considered occupied by bull trout. Bull trout numbers in these streams have declined to the point that they are no longer easily detectable or have been extirpated. Warm Springs Creek is the largest local population in this core area and consists of several streams that support fluvial life history forms (Barker Creek, Foster Creek, West Fork Warm Springs Creek, and Storm Lake Creek) and lakes that support adfluvial life history forms (Upper and Lower Twin Lake Creek and Silver Lake). Fluvial adult bull trout are still present in the main stem Clark Fork River and are typically found in low numbers near occupied tributaries (e.g. Harvey Creek). Twelve bull trout were sampled in the upper Clark Fork River between 1989 and 1994; eight of these fish were found in the vicinity of Warm Springs Creek (PTS 2002) and are likely to be out migrants from Warm Springs Creek (U.S. Fish and Wildlife Service 2004). Results of recent population monitoring completed by Montana Fish Wildlife and Parks

(MTFWP) in the lower portion of the Clark Fork River (between Gold Creek and Missoula) indicate that bull trout numbers are low (less than 1 fish per mile). However, based on the relatively low capture efficiency of the sampling methodology, the actual numbers of bull trout are likely slightly higher.

In 2009 and 2010 a radio telemetry project resulted in the capture and tagging of 4 bull trout in the upper Clark Fork River (near Bearmouth) (MTFWP 2011). One of these bull trout was found dead in mid-June 2009 approximately 0.75 miles below a headgate of the ditch at river mile 0.01 on Harvey Creek. The radio-tagged bull trout had been located in the lower portion of Harvey Creek for over a month prior to its expiration, indicating that Harvey Creek was the bull trout's natal stream. Given the extremely low population size of bull trout in the upper Clark Fork River, any loss of adult bull trout is considered significant (MTFWP 2010). Bull trout have been collected in several irrigation ditches on several streams (Harvey Creek, Boulder Creek Flint Creek, and Warm Springs Creek) in the Upper Clark Fork River core area (2010 MTFWP).

Most of the bull trout in the core area are resident, and there is a high degree of fragmentation between populations. Much of the mainstem of the river as well as the lower reaches of many tributaries are unsuitable for bull trout (warm and dewatered) in midsummer. There are numerous barriers and irrigation diversions which further isolate remaining populations. The proximity of local populations to each other and the condition of migratory corridors (FMO) is of primary concern. However, efforts are underway to arrest and clean up metal contamination in the upper reaches. Impacts to aquatic organisms in the upper Clark Fork River are expected to be greatly reduced, which is anticipated to result in a substantial improvement in water quality and bull trout habitat (U.S. Fish and Wildlife Service 2004).

The monitoring of bull trout redds in this core area has regularly occurred on two local populations (Boulder Creek and Warm Springs Creek). Based on the total redd counts for these two streams, redd numbers have ranged from 21 to 72, averaging 48 per year from 1999 to 2010 (MTFWP 20012). Based on the number of redds, the total adult bull trout population ranges from 100 to 200 fish. Most local populations are well below historical levels of natural abundance and some are too low to maintain long-term genetic viability (i.e., Boulder Creek, Flint Creek and Harvey Creek).

As part of the 5-year status review, an assessment of the relative status of each core area was completed (U.S. Fish and Wildlife Service 2008). The Upper Clark Fork River core area was rated as high risk. High risk core areas consist of limited and/or declining numbers, range, and/or habitat, making the bull trout in this core area vulnerable to extirpation (U.S. Fish and Wildlife Service 2008).

B. Critical Habitat

B.1 Legal Status

Litigation resulted in the U.S. District Court for the District of Oregon granting the Service a voluntary remand of the 2005 critical habitat designation. Subsequently the Service published a proposed critical habitat rule on January 14, 2010 (75 FR 2260) and a final rule on October 18, 2010 (75 FR 63898). The rule became effective on November 17, 2010. A justification document was also developed to support the rule and is available on our website (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species' coterminous range, which includes the Jarbidge River, Klamath River, Coastal-Puget Sound, St. Mary-Belly River, and Columbia River population segments (also considered as IRUs)[1].

Range-wide, the Service designated reservoirs/lakes and stream/shoreline miles in 32 critical habitat units (CHU) as bull trout critical habitat (Table 1). Designated bull trout critical habitat is of two primary use types: (1) spawning and rearing; and (2) foraging, migrating, and overwintering (FMO).

Table 3. Stream/shoreline distance and reservoir/lake area designated as bull trout critical habitat by state.

State	Stream/ Shoreline Miles	Stream/ Shoreline Kilometers	Reservoir/ Lake Acres	Reservoir/Lake Hectares
Idaho	8,771.6	14,116.5	170,217.5	68,884.9
Montana	3,056.5	4,918.9	221,470.7	89,626.4
Nevada	71.8	115.6	-	-
Oregon	2,835.9	4,563.9	30,255.5	12,244.0
Oregon/Idaho	107.7	173.3	-	-
Washington	3,793.3	6,104.8	66,308.1	26,834.0
Washington (marine)	753.8	1,213.2	-	-
Washington/Idaho	37.2	59.9	-	-
Washington/Oregon	301.3	484.8	-	-
Total	**19,729.0**	**31,750.8**	**488,251.7**	**197,589.2**

The rule identifies and designates as critical habitat approximately 1,323.7 km (822.5 miles) of streams/shorelines and 6,758.8 ha (16,701.3 acres) of lakes/reservoirs of unoccupied habitat to address bull trout conservation needs in specific geographic areas in several areas not occupied at the time of listing. These unoccupied areas were determined by the Service to be essential for restoring functioning migratory bull trout populations based on currently available scientific information. These unoccupied areas often include lower mainstem river environments that can provide seasonally important migration habitat for bull trout. This type of habitat is essential in areas where bull trout habitat and population loss over time necessitates reestablishing bull trout in currently unoccupied habitat areas to achieve recovery.

The final rule continues to exclude some critical habitat segments based on a careful balancing of the benefits of inclusion versus the benefits of exclusion. Critical habitat does not include: (1) waters adjacent to non-federal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (Act), in which bull trout is a covered species on or before the publication of this final rule; (2) waters within or adjacent to Tribal lands subject to certain commitments to conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the Service; or (3) waters where impacts to national security have been identified (75 FR

[1] The Service's 5 year review (Fish and Wildlife Service 2008, pg. 9) identifies six draft recovery units. Until the bull trout draft recovery plan is finalized, the current five interim recovery units are in affect for purposes of section 7 jeopardy analysis and recovery. The adverse modification analysis does not rely on recovery units.

63898). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant CHU text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. It is important to note that the exclusion of water bodies from designated critical habitat does not negate or diminish their importance for bull trout conservation. Because exclusions reflect the often complex pattern of land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments.

Conservation Role and Description of Critical Habitat: The conservation role of bull trout critical habitat is to support viable core area populations (75 FR 63943). The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. CHUs generally encompass one or more core areas and may include FMO areas, outside of core areas, that are important to the survival and recovery of bull trout.

As previously noted, 32 CHUs within the geographical area occupied by the species at the time of listing are designated under the final rule. Twenty-nine of the CHUs contain all of the physical or biological features identified in this final rule and support multiple life-history requirements. Three of the mainstem river units in the Columbia and Snake River basins contain most of the physical or biological features necessary to support the bull trout's particular use of that habitat, other than those physical and biological features associated with Primary Constituent Elements (PCEs) 5 and 6, which relate to breeding habitat (see list below).

The primary function of individual CHUs is to maintain and support core areas, which (1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993, p. 19); (2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); (3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); and (4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (MBTSG 1998, pp. 13-16; Rieman and Allendorf 2001, p. 763; Rieman and McIntyre 1993, p. 23).

In determining which areas to designate as critical habitat, the Service considered the physical and biological features that are essential to the conservation of bull trout and that may require special management considerations or protection. These features are the PCEs laid out in the appropriate quantity and spatial arrangement for conservation of the species. The PCEs for bull trout are those habitats components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering (75 FR 63898, p. 2306). The PCEs of designated critical habitat are:

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including, but not limited to, permanent, partial, intermittent, or seasonal barriers.

3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

5. Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; stream flow; and local groundwater influence.

6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departures from a natural hydrograph.

8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

9. Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

B.2 Current Range-wide Condition of Bull Trout Critical Habitat

The condition of designated bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (67 FR 71240). This condition reflects the condition of bull trout habitat. The primary land and water management activities impacting the physical and biological features essential to the conservation of bull trout include timber harvest and road building, agriculture and agricultural diversions, livestock grazing, dams, mining, urbanization and residential development, and non-native species presence or introduction (75 FR 2282).

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PCEs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows:

1. Fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7).

2. Degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii - v, 20-45).

3. The introduction and spread of non-native fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993, p. 857; Rieman et al. 2006, pp. 73-76).

4. In the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine near shore foraging and migration habitat due to urban and residential development.

5. Degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

One objective of the final rule was to identify and protect those habitats that provide resiliency for bull trout use in the face of climate change. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in PCEs 1, 2, 3, 5, 7, 8, and 9. Protecting bull trout strongholds and cold water refugia from disturbance and ensuring connectivity among populations were important considerations in addressing this potential impact. Additionally, climate change may exacerbate habitat degradation impacts both physically (e.g., decreased base flows, increased water temperatures) and biologically (e.g., increased competition with non-native fishes).

B.3 Status of the Clark Fork River Critical Habitat Unit 31

The Clark Fork River Basin CHU includes 5,356.0 km (3,328.1 mi) of streams and 119,620.1 ha (295,586.6 ac) of lakes and reservoirs designated as critical habitat. The subunits within this unit provide spawning, rearing, foraging, migratory, connecting, and overwintering habitat. For a detailed description of this unit and subunits, for justification of why this CHU, included CHSUs, or in some cases individual water bodies are designated as critical habitat, and for documentation of occupancy by bull trout, see Service (2010), or *http://www.fws.gov/pacific/bulltrout*.

The Clark Fork River Basin CHU is essential to maintaining bull trout distribution within this unique geographic region of the Columbia Headwaters Recovery Unit in large part because it represents the evolutionary heart of the migratory adfluvial bull trout life history form (U.S. Fish and Wildlife Service 2009a, p. 32). Flathead Lake and Lake Pend Oreille are the two largest lakes in the range of the species, and bull trout from those core areas historically grew to be large and migrated upstream up to 322 km (200 mi) to spawning and rearing habitats. These habitats were partially fragmented by hydroelectric dams and other manmade barriers but are increasingly being reconnected with dam removal (Milltown Dam) and improved fish passage (Cabinet Gorge, Noxon Rapids, Thompson Falls). The resident life history form of bull trout is minimally present in this CHU and fluvial bull trout play a reduced role relative to adfluvials. The two major lakes (Flathead and Pend Oreille), as well as over 20 additional core areas established in smaller headwater lakes that are isolated from Flathead and Pend Oreille to varying degrees, are the primary refugia for the naturally occurring adfluvial form of bull trout across their range.

C. Analysis of Species/Critical Habitat Likely to be Affected

Bull trout are listed as threatened and critical habitat has been designated under the Act. The proposed action will occur in the Upper Clark Fork River core area and Upper Clark Fork River CHSU. This core area and CHSU share the same geographical boundary. The proposed action will affect one of the 6 local populations of bull trout in this core area and one water body (Warm Springs Creek) designated as critical habitat. The Upper Clark Fork River core area is one of 11 primary core areas in the Clark Fork MU. In 2010, the Service identified the Upper Clark Fork River CHSU as essential to bull trout conservation because it is one of several occupied major watersheds that form the Clark Fork River Basin CHU.

C.1 Previous Consultations and Conservation Efforts

Consulted-on effects are those effects that have been analyzed through section 7 consultation as reported in a BO. These effects are an important component of objectively characterizing the current condition of the species. To assess consulted-on effects to bull trout, we analyzed all of the BOs, 137 in total, received by the Regional offices of Region 1 and 6, from the time of listing until August 2003 (U.S. Fish and Wildlife Service 2003). Of these, 124 BOs (91 percent) applied to activities affecting bull trout in the Columbia Basin population segment, 12 BOs (9 percent) applied to activities affecting bull trout in the Coastal-Puget Sound population segment, 7 BOs (5 percent) applied to activities affecting bull trout in the Klamath Basin population segment, and one BO (< 1 percent) applied to activities affecting the Jarbidge and St. Mary-Belly population segments (Note: these percentages do not add to 100, because several BOs applied to more than one population segment). The geographic scale of these consultations varied from individual actions (e.g., construction of a bridge or pipeline) within one basin to multiple-project actions occurring across several basins.

A total of 119 BOs or Section 10 permits issued take for the Clark Fork River MU since listing to February 6, 2014 (39 from listing to August 2003 and 71 from August 2003 to now). All of the BOs have included mandatory terms and conditions and reporting requirements, which are binding on the action agency, in order to reduce the potential impacts of anticipated incidental take to bull trout. Several projects within this core area overlap and/or run concurrently. Many of these projects have resulted in short-term adverse effects followed by anticipated long-term benefits.

C.2 Conservation Needs

The goal of the draft bull trout Recovery Plan is to describe the actions needed to achieve recovery; that is to ensure the long-term persistence of self-sustaining, complex interacting groups (or multiple local populations that may have overlapping spawning and rearing areas) of bull trout distributed across the species' native range. Recovery of bull trout will require reducing threats to the long-term persistence of populations, maintaining multiple interconnected populations of bull trout across the diverse habitats of their native range, and preserving the diversity of bull trout life-history strategies (*e.g.*, resident or migratory forms, emigration age, spawning frequency, local habitat adaptations) (U.S. Fish and Wildlife Service 2002, p. v.).

The draft bull trout Recovery Plan (Fish and Wildlife Service 2002a, p. vii) identifies the following tasks needed for achieving recovery: (1) protect, restore, and maintain suitable habitat conditions for bull trout, (2) prevent and reduce negative effects of non-native fishes, such as brook trout, and other non-native taxa on bull trout, (3) establish fisheries management goals and objectives compatible with bull trout recovery, (4) characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout, (5) conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks, (6) use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats, (7) assess the implementation of bull trout recovery by MUs, and (8) revise MU plans based on evaluations.

Central to the survival and recovery of the bull trout is the maintenance of viable core areas (U.S. Fish and Wildlife Service 2002a and 2004d). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat, and in some cases in their use of spawning habitat. Some of the actions needed in the Clark Fork MU and Clark Fork River core area include reducing general sediment sources, upgrading problem roads, and improving instream flows (U.S. Fish and Wildlife Service 2002b, pp. 141-162)

Temperature regimes associated with global climate change also threaten bull trout persistence. Because air temperature affects water temperature, species at the southern margin of their range that are associated with cold water patches, such as bull trout, may become restricted to smaller, more disjunct patches or become extirpated as the climate warms (Rieman et al. 2007, p. 1560). Rieman et al. (2007, pp. 1558, 1562) concluded that climate is a primary determining factor in bull trout distribution. Some populations already at high risk, such as the Jarbidge, may require "aggressive measures in habitat conservation or restoration" to persist (Ibid., p. 1560). Conservation and restoration measures that would benefit bull trout include protecting high quality habitat, reconnecting watersheds, restoring flood plains, and increasing site-specific habitat features important for bull trout, such as deep pools or large woody debris (Kinsella 2005, entire).

V. Environmental Baseline

Regulations implementing the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq., 50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed federal projects in the action area which have already undergone section 7 consultation and the impacts of State and private actions which are contemporaneous with the consultation in progress. Such actions include, but are not limited to, previous timber harvest, road construction, residential development and other land management activities.

The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this BO encompasses the section of Warm Springs Creek from its confluence with the Clark Fork River upstream approximately 15 miles to Meyers dam. The action area is the portion of the total area where activities and activity-related impacts may influence the habitat, movement, habitat use, and persistence of bull trout. The action area is the portion of the total area where activities and activity-related impacts may influence the habitat, movement, habitat use, and persistence of bull trout. The action area contains two projects areas, Section 32 and Lower Warm Springs Creek (see U.S. Environmental Protection Agency 2014, Figure 2-2).

The environmental baseline conditions for bull trout were assessed using information in the biological assessment (U.S. Environmental Protection Agency 2014), Bull Trout Conservation Strategy (U.S. Forest Service 2013), Section 7 Consultation Watershed Baseline: Upper Clark Fork River (U.S. Forest Service 2000a and 2008), draft Bull Trout Recovery Plan (U.S. Fish and Wildlife Service 2002a; U.S. Fish and Wildlife Service 2002b), Final Rule for Bull Trout Critical Habitat, and other sources of information.

A. Status of the Species and Critical Habitat within the Action Area

Action agencies authorizing activities within lands occupied by bull trout are mandated by the Act to consider the environmental baseline in the action area and effects to bull trout that would likely occur as a result of management actions. The EPA uses the following impact analysis approach titled "A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale" (framework/matrix; U.S. Fish and Wildlife Service 1998a). The framework/matrix defines the biological requirements for bull trout and facilitates the evaluation and relevance of the environmental baseline to the current status of the species to determine the effect of the proposed action and whether the species can be expected to survive with an adequate potential for recovery. The evaluation of the pathway and subsequent indicators are conducted at the scale of the action area to establish the environmental baseline. Definitions for the baseline determinations Functioning Appropriately (FA), Functioning at Risk (FAR), and Functioning at Unacceptable Risk (FUR) are discussed in U.S. Fish and Wildlife Service 1998a, Table 1 at page 20.

Habitat indicators that are FA provide habitats that maintain strong and significant populations, are interconnected, and promote recovery of a proposed or listed species or its critical habitat to a status that will provide self-sustaining and self-regulating populations. When a habitat indicator is FAR, they provide habitats for persistence of the species but in more isolated populations and may not promote recovery of a proposed or listed species or its habitat without active or passive restoration efforts. FUR suggests the proposed or listed species continues to be absent from historical habitat, or is rare or being maintained at a low population level; although the habitat may maintain the species at this low persistence level (i.e., PCEs are not providing their intended recovery function) active restoration is needed to begin recovery of the species. The following table describes the matrix habitat indicators and associated PCEs and condition classes (i.e. FUR FAR, FA) for the two project areas within the action area.

Table 4. Checklist for documenting the environmental baseline for the species and habitat indicators for bull trout and bull trout critical habitat in the project areas (U.S. Environmental Protection Agency 2014).

Diagnostic/Pathways: Indicators and PCE	Project Areas	
	Section 32	**Lower Warm Springs**
	FA/FAR/FUR	**FA/FAR/FUR**
Subpopulation Characteristics:		
Subpopulation Size	FUR	FUR
Growth & Survival	FUR	FUR
Life History Diversity & Isolation	FUR	FUR
Persistence and Genetic Integrity	FUR	FUR
Water Quality:		
Temperature 2,3,5,8	FAR	FAR
Sediment 2,3,6,8	FAR	FAR
Chemical Contaminants/Nutrients 1,2,3,8	FUR	FUR
Habitat Access:		
Physical Barriers 1,2,3,9	FUR	FAR
Habitat Elements:		
Substrate Embeddedness 1,3,6	FAR	FA
Large Woody Debris 4,6	FAR	FUR
Pool Frequency & Quality 3,4,6	FUR	FAR
Large Pools 4,5	FAR	FA
Off-Channel Habitat 4	FAR	FUR
Refugia 2,5,9	FUR	FAR
Channel Condition & Dynamics:		
Wetted Width/Max Depth Ratio 2,4,5	FUR	FAR
Streambank Condition 1,4,5,6	FAR	FAR
Floodplain Connectivity 1,3,4,5,7,8	FAR	FAR
Flow & Hydrology:		
Change in Peak/Base Flows 1,2,5,7,8	FUR	FAR
Drainage network Increase 1,7,8	FAR	FAR
Watershed Conditions:		
Road Density & Location 1,5,7	FAR	FAR
Disturbance History 4,7,8,9	FUR	FUR
Riparian Conservation Area 1,3,4,5,7	FAR	FAR
Disturbance Regime 4,6,8	FUR	FUR
Integration of Habitat	FUR	FUR

During 2007 fish sampling events, the species composition found in Warm Springs Creek above Meyers Dam differed significantly from sampling locations located below the dam. Above the dam, species composition consists primarily of rainbow and cutthroat trout followed by bull trout. For example, at river mile 23.3, no brown or bull trout were collected, and trout composition consisted entirely of rainbow and cutthroat trout (65 percent) and brook trout (35 percent). However, bull trout (40 percent) were the most abundant species collected at river mile 27.4, with westslope cutthroat (27 percent) and brook trout (30 percent) being almost equally common. Below the dam (in the action area) brown trout are the most common fish species. At river miles 1.8, 7.4, and 8.4, brown trout dominated the species composition making up 99 percent or greater of the fish collected.

Bull trout have been reported below Meyers Dam within the action area at low densities. The survey report shows the presence of a single bull trout (11 inches) at the head of Gardiner Ditch, which is located just upstream of the Section 32 project area at river mile 10.3 (MTFWP 2011). It is likely that fish below Meyers Dam are migrants from upper Warm Springs Creek and its connected tributaries and lakes. While bull trout have recently been documented at low densities within the action area, the likelihood of bull trout occupancy in Warm Springs Creek has increased somewhat since 2008, and may be due to the removal of Milltown Dam, which eliminated a barrier to bull trout migration to the Upper Clark Fork River watershed and Warm Springs Creek.

Both project areas are FUR for each of the four population indicators, due largely to the absence of a migratory life history form. Of the 19 habitat indicators, the Section 32 project area contains 11 that are FAR and 8 that are FUR, and the Lower Warm Springs Creek project area contains 2 that are FA, 12 that are FAR, and 5 that are FUR. The role of critical habitat in the action area is to provide FMO habitat functions. At least one habitat indicator used to assess each of the nine PCEs is rated as FUR or FAR. Therefore, PCEs in the action area provide habitats for persistence of the species, but in more isolated populations, may not promote recovery of a proposed or listed species or its habitat without active or passive restoration efforts. Nonnative species are present throughout the system and are a significant threat to the bull trout recovery. A detailed description of the condition class for each habitat indicator can be found in Table 4-1 of the BA (U.S. Environmental Protection Agency 2014).

B. Factors Affecting Species Environment (Habitat) Within the Action Area

There are numerous factors affecting bull trout and critical habitat in the action area, including: grazing, agriculture (water quantity and quality), mining impacts (degraded water quality and channel straightening), and non-native fish species. The primary factors influencing aquatic habitat and native fish populations in the action area include non-native fish (i.e. brown trout), irrigation diversions, and degraded water quality from historic mining practices.

Non-native brown trout and brook trout are often cited as contributing to the decline of native fish (MBTSG 1995). Brown trout, brook trout, and rainbow trout are the most common trout species in lower (downstream of Meyer Dam) Warm Springs Creek. The lower reaches of Warm Springs Creek contain spawning habitat for Clark Fork River brown trout and are likely major sources of brown trout recruitment to the Clark Fork River.

The nature of negative interaction between bull trout and brook trout is thought to include competition, predation, and hybridization. The result of species interaction is suspected to be detrimental to bull trout given apparent over lapping niches of these two species (Leary et al. 1983). Kanda et al. (2001) found that hybridization tends to occur between male brook trout and female bull trout indicating a greater reproductive wasted effort for bull trout than brook trout. The degree of hybridization, other interactions, and distribution of the two species is likely influenced by habitat condition (Rieman and McIntyre 1993). Bull trout are rare, if present at all, in many streams supporting large numbers of brook trout (Buckman et al. 1992; Ziller 1992; Rich 1996). Rich (1996) found brook trout in the Bitterroot River system occupied more degraded stream reaches than bull trout. Leary et al. (1993) documented a shift in community dominance from bull trout to brook trout in Lolo Creek and expected the trend to continue until bull trout are displaced from the stream. Gunckel et al. (2002) found that when resources are scarce brook trout will likely displace bull trout. Adams et al. (1999) suggested that bull trout brook trout interaction is likely to result in bull trout replacement (non-native species invading after declines in native species) rather than displacement (non-native causing the decline). Rich et al. (2003) suggested that bull trout may resist brook trout invasion in streams with high habitat complexity and "strong" neighboring population.

The two irrigation diversions in the action area include the Gardiner Ditch just upstream of the Galen Road and the MTFWP ditch that provides water to the Waterfowl Management Area located at river mile 1.8. Several smaller diversions exist in the lower reaches of Warm Springs Creek, but few are in operation (CDM Smith 2012). Water may only be diverted into the Gardiner Ditch when flows reach 40 cubic feet per second (cfs) at the upstream U.S. Geological Services (USGS) gaging station as well as at the downstream USGS gage near Warm Springs. The upper gage determines the water that is available, and the lower gage controls when water must be left in the stream. In dry years, including the irrigation seasons of 1998 to 2002, the stretch between Gardiner Ditch and the confluence with the Clark Fork River is frequently dewatered by water diversions (MTFWP 2006). The USGS gage data indicates that in a typical year, 20 to 30 percent of total discharge is lost in this portion of Warm Springs Creek, primarily to irrigation. Additional volume is lost to side channels, where water ponds and infiltrates or evaporates. Despite the surface water losses, groundwater inputs east of the Anaconda-Bowman Field airport and recent in-stream flow agreements have led to fairly good summer base flows throughout the lower reaches of Warm Springs Creek (MTFWP 2010).

Irrigation diversions can impact stream temperatures by reducing the total volume of water. Meehan (1991) suggests that low flow streams exhibit greater daily fluctuations in stream temperature. In the action area, water temperature data obtained from the USGS gage at Warm Springs for the years 2001 to 2012 shows that monthly mean temperatures fall below the 59° F (15° C) bull trout suitability threshold, with July recording the highest mean temperature of 58.3° F (14.6° C). However, daily mean maximum temperatures routinely exceed the suitability threshold beginning in mid-June and ending in early September.

Entrainment effects from unscreened headgates and fish passage have been identified in this core area as having negative impacts on bull trout. A survey of the Gardiner Ditch resulted in the capture of one bull trout and numerous brown trout. No bull trout were detected in the MTFWP ditch (MTFWP 2011).

Channel straightening has changed the slope of the stream bed in several areas and has caused downcutting, bank erosion, and stream bed aggradation downstream of the modified sections. Channelization is most evident within the city of Anaconda, immediately downstream of Galen Road

(CDM Smith 2012). For example, in the Section 32 project area (i.e., the portion of stream between Galen Road) approximately 30 percent of the channel appears to have been historically straightened. Whether this reach historically functioned more as a depositional area with multiple channels or as a single thread channel is difficult to determine given the extent of anthropogenic impacts. Approximately 1,000 feet downstream of the Galen Road crossing, a braided, depositional reach begins in an area that appears to have been historically straightened. A large debris dam causes flow to leave the main channel, resulting in a loss of approximately 50 percent of its flow. In February 2013, ice dams located upstream of the braided system were causing water to spill out of the channel and into adjacent fields to the north and south. The low velocities and shallow depths associated with large portions of Section 32 also contribute to the formation of ice dams. The depositional characteristics of this reach are likely the result of significant historic sediment deposition. This sediment likely originated from upstream of Galen Road and was probably mobilized by the high hydraulic capacity caused by channelization near Anaconda. Remedial activity in 2009 through 2010 resulted in approximately 650,000 cubic yards of material being removed from the floodplain, altering out of bank flow paths and increasing the risk of bank avulsions. Additionally, Warm Springs Creek is perched above the floodplain in a number of locations. This perched condition increases the risk of Warm Springs Creek abandoning the existing channel and creating an alternate flow path (i.e. connecting to Dutchman Creek or Lost Creek to the north).

Water quality remains a concern within the action area. The effects of past mining are still apparent in many locations and affect at least half the stream length in the action area. Due to historic metals ore processing and smelting, large quantities of flood-deposited tailings are present throughout the valley surrounding Warm Springs Creek. These deposits were derived from exposed and easily eroded mine and smelter wastes and tailings and are composed of a number of metals such as arsenic, cadmium, copper, iron, manganese, lead, and zinc (Smith et al. 1998).

The stream corridor within the action area was contaminated via multiple pathways including aerial deposition from the smelter complex, fluvial deposition from historic flooding, re-suspended dusts from barren and sparsely vegetated areas, and deposition of fugitive dust from the nearby tailings ponds. Sample data from soils indicate that the arsenic open space action level of 1,000 mg/kg is often exceeded along Section 32 stream corridors. Data also show that copper is present in very high concentrations in the action area. Sampling of the underlying soils after surficial layers were stripped until arsenic concentrations were below 250 mg/kg indicate that while much of the highest concentrations were removed by earlier remedial actions, copper still remains in the floodplain at moderate to high concentrations (CDM Smith 2012).

These contaminated deposits exist within the stream channel and the 100-year floodplain of Warm Springs Creek, and have the potential to impose chronic toxicity on the biota of the watershed. Metal bearing minerals are often altered by mining, weathering, and fluvial processes to become more bioavailable and some bioaccumulate up the human health and ecological food chains. These food chain effects interrupt natural cellular processes in the body resulting in a myriad of health problems, particularly concerning the nervous system (NPS 2007).

Water quality standards within the action area are exceeded periodically caused by surface water runoff from aerially contaminated soils and from areas of evaporative salts, erosion of fluvially deposited tailings into receiving water bodies, and contaminated ground water discharges into perennial flow drainages. To meet the remedial action objectives, EPA and Montana Department of

Environmental Quality (DEQ) will require reclamation of contaminated soils, engineered storm water management options to control overland runoff, and other engineering controls to minimize releases from fluvially deposited tailings.

The Montana Water Quality Standard classification for Warm Springs Creek is B-1, indicating that its waters are to be "maintained suitable for drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply" (MTFWP 2006). However, due to high levels of arsenic and other contaminants of concern, the lower reaches of Warm Springs Creek have failed to meet this standard (U.S. Environmental Protection Agency 2013). Impaired water quality has also resulted from nutrient loading, sedimentation, flow alterations, channelization, and loss of woody riparian vegetation.

In 2009 and 2010, Atlantic Richfield remediated large portions of the Section 32 project area on either side of the stream corridor. Prior to remediation, the landscape consisted of barren, denuded, and sparsely vegetated areas contrasted with areas of good water availability supporting significant vegetation growth. An upland grass mixture was planted that is specifically designed to tolerate high concentrations of copper and other metals in the soil. The vegetation in open areas is currently dominated by wheatgrasses, basin wildrye, fescues, and redtop. A moderately dense canopy is present along the stream channel and consists largely of aspen, birch, cottonwood, and willow (CDM Smith 2012). Floodplain materials were not replaced, therefore the adjacent floodplain is lower in elevation than the stream channel. Portions of the stream channel are perched above the floodplain resulting in an increased risk for avulsion capturing the entire flow if such an event were to occur.

VI. Effects of the Action

"Effects of the action" refer to the direct and indirect effects of an action on the species or critical habitat, which, when combined with the effects of other activities interrelated or interdependent with that action, will be added to the environmental baseline. Direct effects are considered immediate effects of the project on the species or its habitat. Indirect effects are those caused by the proposed action and are later in time, but are still reasonably certain to occur. Interrelated actions are part of a larger action and depend upon the larger action for their justification. Interdependent actions have no independent utility apart from the action under consultation.

A. Analyses for Effects of the Action

Overall, the proposed action is expected to result in long-term beneficial effects on bull trout and bull trout designated critical habitat. These expected benefits are primarily the result of improved water quality and are expected to extend indefinitely into the future throughout the action area. However, despite these overall expected benefits, there is a potential for short-term and some minor long-term adverse effects on bull trout. Resultant short-term adverse effects would be small in magnitude, short in duration, and temporary in nature when compared to the overall benefits of improved water quality.

Potential long-term adverse impacts vary in their significance to bull trout and bull trout habitat. The loss of wetland habitat in Section 32 is relatively insignificant to bull trout directly, but may have indirect effects related to prey recruitment. The establishment of four perpendicular berms may trap individual bull trout as flood waters recede; however, the likelihood of entrapment is low given the current low population levels. Conversely, the loss of undercut bank habitat is likely and would eliminate refugia for bull trout. However, the removal of undercut bank habitat is required to improve bank stability and riparian condition, which will result in improved water quality and stream shading. Overall, it is expected that any residual adverse effects would be outweighed by the long-term benefits expected to accrue for bull trout and bull trout critical habitat once remediation activities have been completed.

A detailed discussion on the effects of the proposed action to PCEs and associated habitat indicators is provided on pages 4-8 through 4-24 of the BA. Below is an abbreviated discussion on the effects of the project to the primary habitat indicators and PCEs of concern. The proposed action would primarily affect habitat indicators sediment (PCE 6 and 8), chemical contamination (PCE 8), barriers (PCE 2), large woody debris (LWD) (PCE 4), pool frequency (PCE 4), streambank condition, (PCE 4), and floodplain connectivity (PCE 2). The proposed action may also affect bull trout by stranding or entrapment of individuals during channel reconstruction activities and as a result of the construction of flood control berms perpendicular to the stream channel and below the elevation on the existing stream channel. The preceding paragraphs were taken predominantly from the BA pages 5-2 through 6-5 (U.S. Environmental Protection Agency 2014).

Sediment: Increased sediment loading to Warm Springs Creek is expected to occur as a result of ground disturbance within the floodplain and stream channel. Ground disturbing activities within the floodplain include the installation and removal of temporary haul roads, excavation and removal of visible tailings, and installation and removal of flood control berms. Activities within the stream channel that will result in sediment effects include the installation and removal of temporary stream crossings, channel reconstruction, woody debris removal, selective vegetation removal, and bank stabilization.

For construction activities within the floodplain, until permanent vegetation is established, exposed soils and sediments would be more prone to erosion and transport into the creek, potentially impacting bull trout habitat. Although there is a potential for a short-term increase in sediment and COCs due to the increased floodplain erosion, the low metals concentration and implementation of BMPs will likely reduce runoff and the potential for negative impacts on surface water quality (U.S. Environmental Protection Agency 2014).

In addition to sediment delivery as a result of floodplain erosion, instream construction activities are anticipated to result in temporary pulses of suspended sediment and COC. The proposed action includes the use of up to 5 temporary stream crossings. The Section 32 and Lower Warm Springs Creek project areas require temporary stream crossings to excavate and haul impacted soil and replacement backfill within the Warm Springs Creek corridor. A single crossing is expected to be needed to remove/replace impacted material from the "island" located in the Section 32 project area. The Lower Warm Springs Creek project area includes both broad and isolated removal areas across approximately 2.5 miles of the corridor. It is expected that 3 to 5 crossings would be needed for this work. Construction is planned to commence in late 2014 and is expected to be completed in late 2015. All temporary crossings would be removed during winter shutdown (i.e., December- April) and spring runoff periods. As a result, crossings are expected to be necessary during approximately half the year (i.e., July through November). Individual crossings would be removed once remedial activities have been completed within a given reach and the crossing is no longer required (TREC 2014) (EPA BA). Stream crossing removals and replacements are anticipated to result in increases in suspended sediment and will likely last only a few hours or days, and re-deposited sediments would be flushed quickly downstream. These initial short-term impacts are expected to be offset by long-term improvements in streambank condition by removing contaminated soils to improve water quality and riparian condition.

Increased sedimentation associated with proposed remedial actions is expected to be temporary in nature. No spawning or incubation occurs within the action area. Sediment will, however, be delivered and re-suspended and deposited downstream, causing some filling of interstitial spaces that are important for bull trout rearing. The proposed action will disturb the streambed and areas adjacent to the stream and result in short-term increases in suspended sediment in the creek. High levels of suspended sediment can result in changes in physiological stress (e.g., gill trauma) behavior (e.g., reduced feeding rates, delayed migration) and habitat degradation (e.g., fill of interstitial spaces).

Newcombe and Jensen (1996) showed that construction effects on fish are based on the concentration of suspended sediment during the time of exposure. Past monitoring efforts indicate that suspended sediment levels that are elevated during the construction activity can quickly (within 1 to 3 hours post construction) return to pre activity levels. The duration and magnitude of sediment load increases during instream construction are a function of flow volume, sediment particle sizes, and the effectiveness of BMPs. Low flows can result in minimal dilution and high suspended solid concentrations. However, the distance of downstream transport may be minimized. At the other extreme, high flows associated with storm events can increase background levels and entrain exposed sediment at the crossing location, but may also dilute concentrations of solids and transport materials further downstream. The downstream extent and concentrations of the sediment plume is also a function of the particle sizes of the material excavated. In this case, gravel and coarse sands are the most common materials, and they will settle out downstream relatively close to the project site.

In-channel construction activities such as the ones proposed necessarily cause sediment to be re-suspended from the streambed and flushed downstream. However, the exact volume of sediment redistributed is difficult to estimate due to the imprecise nature of the excavation and the natural variability in sediment sizes on the stream bottom. Since the project will be implemented during low flow, most of the sediment will likely be stored in the channel within a short distance downstream of the construction sites. This sediment will be flushed further downstream with the first high flow event in the spring. Bull trout are not known to spawn in lower Warm Springs Creek; therefore, no effects to egg incubation are expected. The primary effects of this sediment redistribution and deposition would be through exposure to high amounts of suspended sediments and filling of interstitial spaces in the river bottom. Exposures to high amounts of suspended sediment can result in physiological stresses. Filling of interstitial spaces can affect juvenile rearing habitat and aquatic macroinvertebrate production, thereby affecting growth and survival of bull trout in the reach. The expected impact of sediment increases will have similar impacts to PCE 6 as described on pages 4-20 and 4-21 of the BA (U.S. Environmental Protection Agency 2014)

As a result, short-term sediment impacts in the reaches immediately downstream of the construction sites are expected to be moderate. In the long- term, redistributed sediment associated with the project will gradually migrate downstream over time, which may result in a minor increase in embeddedness within the channel in the first 1 to 2 miles downstream for one to three years.

Due to the low likelihood of bull trout being present in the action area, the potential for localized short-term sediment effects to adult and juvenile bull trout is low, but cannot be ruled out altogether. The implementation of BMPs outlined in the SWPPP and in the RAWP will likely prevent significant sediment inputs and will minimize overall effects on bull trout and bull trout habitats. BMPs to implement are discussed at the end of this section.

Chemical Contamination: Impacts to this indicator are similar in timing and frequency as described above under the sediment indicator. That is to say, construction activities are anticipated to result in multiple pulses of increased levels of COC in the water column. Determining toxicity of COC to fish can be difficult because it can be influenced by age, species, and developmental stage. In addition, the chemical properties of water hardness, water temperature, and dissolved oxygen can affect toxicity. Fish exposed to increased levels of COC in the action area can be affected by three pathways, direct contact (olfactory, gill respiration, lateral line) with chemicals dissolved or suspended in river water, ingestion of food items with COC incorporated into their tissues, and incidental ingestion of contaminated sediments during normal feeding activities. The concentration value used for evaluating hazard from direct contact with surface water may be expressed either as total recoverable metals or as dissolved metals. In general, effects of direct contact exposure are better correlated with dissolved rather than total metal concentrations. The BA did not estimate potential increases in COC and associated impacts to bull trout. However, based on the amount of ground disturbance and length of the project, the Service anticipates impacts associated with temporary increases in COC to occur. Increases in COC during construction activities is expected to be low as BMPs are likely to be effective in controlling surface erosion and re-suspension of materials within the stream channel.

The primary benefits from the proposed action include improvements to water quality. Contamination due to smelting operations has degraded water quality and sediment quality with elevated levels of heavy metals, particularly copper, observed during high flows. Within Section 32, significant quantities of contaminated sediment have already been removed from the floodplain. When compared with Section 32, Lower Warm Springs Creek still possesses significant quantities of contaminated sediment within the floodplain that makes its way into the stream through erosion and flood events. The proposed remedial actions would result in improved water quality so that Warm Springs Creek will meet water quality standards resulting in improved habitat for bull trout. Removal of fluvial wastes and soil/waste mixtures identified in the Final Design Report (FDR) (CDM Smith 2012) would reduce arsenic and copper concentrations below the applicable cleanup level of 1,000 mg/kg within RDU 10 (Atlantic Richfield 2013). Contaminant removal activities would reduce the baseline level of heavy metals within the stream. As a result, the likelihood that concentration levels would spike during high flows would be reduced, such that adverse impacts upon bull trout via ingestion and bioaccumulation in prey items are not expected.

Physical Barriers: As discussed above the proposed action will result in the installation and removal of several stream crossings. Stream crossings have the potential to impede fish passage when installed improperly. All temporary stream crossings will accommodate fish passage across the range of design flow rates expected to occur during the time period in which culverts would be in place (July through November) (TREC 2014). Temporary crossings will consist of closed bottom, arch (squash) corrugated, metal pipe designs. The expanded base width, coupled with flow baffles, will result in reduced flow velocities to accommodate fish passage across the range of design flow rates expected to occur during the time period in which culverts would be in place (July – November). Detailed calculations and design information are provided in the Calculation Brief included as an attachment to the TREC memo (TREC 2014). Culverts will be removed from December to April to allow for unimpeded winter and spring movements, bull trout are fall migrants.

Large Woody Debris: The proposed action has the potential to affect LWD frequency primarily through the direct removal of wood from the channel. In the existing condition, LWD is naturally limited within the Section 32 project area due to narrow forested riparian corridors. However, LWD has accumulated in several locations due to natural choke points and beaver activity. This accumulation has contributed to the diversion of flow out of the main channels and into side channels. Accumulations of LWD are often cited as causing the build-up of ice and debris dams which result in localized flooding. One of the goals of the proposed remedial actions is to remove debris from stream channels and to limit future LWD for flood control purposes. The expected decrease in LWD would reduce the in-stream structure and cover preferred by bull trout. In areas with large boulders, undercut banks, or other sufficient cover, the impact of less LWD would be minimal. However, in many areas, LWD provides the only cover present, and its removal and future absence may render these stream reaches unsuitable for bull trout.

Pool Frequency and Quality: Within Section 32, there is a high degree of channel complexity due to the presence of a braided, alluvial fan system and numerous secondary side channels. While this complexity increases the amount of off-channel wetland habitat, it also promotes sediment deposition, debris accumulation, bank instability, and a significant increase in width-to-depth ratios which is an indicator of poor water depth. The proposed remedial actions seek to divert flows back into main channels to improve sediment transport, water depths, channel integrity, and bank stabilization. While this may decrease overall channel complexity, it is expected to increase habitat conditions favorable to bull trout including pool frequency and depth. This includes providing adequate base flows, stable streambanks, active floodplain connections, and large pools. Land use restrictions in riparian areas would maintain and conserve habitat quality and complexity. In-stream construction activities would include scouring the streambed to different depths to increase pool microhabitat. Portions of Section 32 downstream of the braided system contain more typical riffle/pool sequences containing a greater number of large, deep pools. Pools in these areas may gain depth from increased flow, but would largely be unaffected by proposed remedial actions.

Lower Warm Springs Creek does not contain multiple channel types like Section 32. Lower Warm Springs Creek largely contains a C-type channel with a moderate to high width-to-depth ratio. However, the project area still possesses a high degree of channel complexity due to the presence of established riffle/pool sequences. These sequences provide a wide variety of velocity-depth combinations which support a wide range of aquatic habitats. Consequently, habitat heterogeneity provides bull trout with access to a variety of food sources, thermal refugia, and cover.

Reactivating a historic channel in the Lower Warm Springs project area by diverting flows back into the historic channel would transform the existing channel into an off-channel pond or wetland habitat. This off-channel habitat would be connected to the main channel during flood events and could provide expanded foraging opportunities for bull trout when accessible.

Streambank Conditions: The proposed action has the potential to affect this habitat indicator as a result of physical disturbance of the streambank for the removal of contaminated soils and streambank reconstruction.

The streambank treatments for Warm Springs Creek will consist of a combination of biodegradable materials and live plant materials to provide both immediate and long-term stability. A suite of streambank stabilization and revegetation treatments has been proposed that correspond to the different streambank conditions observed within the project reach. Eroding streambanks will be stabilized following removal of contaminated materials while relatively stable banks with existing desirable vegetation will be preserved or enhanced to the extent possible. Treatments will largely focus on stabilizing outer bends where shear stresses against eroding banks have been observed to be highest. Actual treatment locations and extents are subject to vary from those identified in figure 2.2 and 2-12 in U.S. Environmental Protection Agency 2014. Bank stabilization techniques are described in detail on in sections 3.10.1.1-7 of the Remedial Action Work Plan, Remedial Design Unit 10 Warm Springs Creek (Atlantic Richfield 2013).

Soft engineering approaches and efforts that allow the stream channel to move across the floodplain. Connected floodplains allow for the renewal of physical and biological interactions that support complex aquatic habitats important to bull trout. The stream would be further protected by implementing institutional controls such as grazing restrictions or other land use restrictions, and future monitoring and maintenance of the stream and project areas (CDM Smith 2012).

In the Section 32 project reach, the stream channel is less established and prone to lateral migration and/or bank avulsions. The proposed design includes reconstruction of the historic channel through this braided reach. This design improves conveyance through the Section 32 project reach and reduces the risk of channel avulsions.

For the Lower Warm Springs project area the proposed design incorporates both channel reconstruction and bank stabilization to reduce lateral migration and bank erosion. In comparison to Section 32, Lower Warm Springs Creek contains large stretches of undercut banks created by scouring beneath dense root masses. Bull trout will often use undercut banks for cover and are considered components of optimal bull trout habitat. Remedial actions and bank reconstruction would remove a significant portion of existing undercut banks, thereby degrading bull trout habitat in the short-term. However, long-term bank stability and shallower bank slopes would improve water quality, create productive shallow-water habitats, and would replace undercut bank habitat with in-channel structure provided by willow plantings.

Grazing and other land use restrictions associated with proposed remedial actions would protect riparian, floodplain, and streambank areas from degradation and result in beneficial effects to PCE 5. These restrictions would limit access to remediated floodplain areas and streambanks and would be consistent with the Final Institutional Control Management Plan (ICMP). These restrictions would be beneficial to bull trout and bull trout critical habitat in the short-term and long-term by reducing nutrient and pathogen inputs, preventing bank trampling, and protecting riparian vegetation.

Floodplain Connectivity: The proposed action includes the removal and construction of earthen berms within the floodplain in Section 32 of the project area (see Figure 2-5 in U.S. Environmental Protection Agency 2014).

The removal of an existing berm located within the active floodplain, known as the "Nike" berm will be removed (see Figure 2-5 in U.S. Environmental Protection Agency 2014). The floodplain in this area will now be accessible to out of bank flows allowing for inundation during events exceeding the capacity of the north and south channels. Benefits to vegetation will be almost immediate due to the increase in moisture and natural recruitment opportunities.

Disturbance to remove the existing berms and impacted soils will be limited to a small area in Section 32. Although there would be short-term disturbances including removal of existing vegetation and resulting temporary sediment inputs during construction, vegetation is expected to establish itself quickly due to increased moisture and opportunity for natural recruitment of native vegetation.

The proposed action includes construction of a flood control berm in the upper portion on Section 32 (see Figure 2-5 U.S. Environmental Protection Agency 2014). The proposed action will also greatly alter the existing 100 year floodplain. Areas to the south of Highway 48 would no longer be considered within the 100 year floodplain. Large areas to the north and adjacent to the airport, would also no longer be considered within the 100 year floodplain. However, more water would be available within the main channel of Warm Springs Creek during flow events. The changes in the floodplain as a result of the proposed action are depicted on figure 2-6 in U.S. Environmental Protection Agency 2014. The primary berm of concern is located immediately downstream of the Galan Road. The floodplain in this area is lower in elevation and has been narrowed in this section as a result of previous remediation activities. The installation of flood control berms perpendicular to the stream channel does not address the concerns with a lowered floodplain. The Service anticipates that these berms would pond and divert some flow back to the main channel once every 10 to 25 years during high flow events. This design (perpendicular berms to the stream channel) while an improvement over the current conditions will, over the long-term, reduce linkage of wetland, floodplains and riparian areas to main channel and impede riparian vegetation/succession to providing healthy riparian vegetation. However, the area most affected is small and would occur only during high flow events (once every 10 to 25 years).

Entrapment: The proposed action has the potential to result in entrapment of bull trout during stream channel reconstruction activities in Lower Warm Springs Creek and as a result of flood control berms constructed in the Section 32 project area.

The proposed action includes the construction of lateral berms (see Figure 2-5 in U.S. Environmental Protection Agency 2014). Four lateral berms are to be constructed to help control flooding to the north and northeast of the project area. During flood events, bull trout may access floodplain areas between the berms in search of food. As floodwaters recede, there is a possibility that bull trout could be trapped and stranded, and unable to return to the main channel of Warm Springs Creek. The probability of frequent and/or significant bull trout entrapment is low.

As mentioned above the proposed actions in lower Warm Springs Creek includes the reactivation of a historic channel and resultant abandonment of the existing channel in the Lower Warm Springs

Creek project area. During the construction activities associated with the reactivation of the main historical channel in Section 32, flows would be temporarily diverted into a lined secondary channel by installing a "plug" in the main channel. Plugs will consist of Ecoblocks and metal sheeting. The temporary bypass channel will be designed to accommodate flows during low flow periods and allow for fish passage. Once the construction activities in the channel are completed, the "plug" would be removed in such a manner to minimize disturbance and limit sediment loading and increased turbidity in the stream to the maximum extent possible.

During the initial installation of diversion structures and the diversion of flows, the movements of individual bull trout could be impeded; however, individuals would likely turn around or access alternative routes (i.e., secondary channels) when confronted with such a physical barrier. A greater threat to bull trout is when permanent plugs are installed. Permanent plugs would cut-off braided channels in Section 32 and the existing channel in Lower Warm Springs Creek. The potential exists for individual bull trout to become trapped in these impounded channels, particularly the existing channel in Lower Warms Springs Creek as it is not expected to dry out. The impact of entrapment could be lessened with the establishment of a catch and transport plan for these areas.

Fish salvage will occur when diverting a stream around a project site to minimize adverse impacts. Listed fish effects from work area isolation and fish capture, handling, and relocation include physical injury, death, and physiological stress during capture, holding, or release; predation and cannibalism; and potential horizontal transmission of disease and pathogens and stress-related phenomena. If electrofishing is used to salvage fish, it will particularly increase stress and injury levels. Although some death of listed fish will occur from electrofishing, fish will only be exposed once to the stress caused by work area isolation activities, and the fish relocation activity is only expected to last a few hours. If construction took place without work area isolation, it is possible more fish could be injured or killed.

Summary: Implementation of the proposed remedial actions would be expected to have an overall, long-term beneficial effect on bull trout and bull trout designated critical habitat. These expected benefits would be realized for the Section 32 and Lower Warm Springs Creek project areas and areas located directly adjacent and downstream. Long-term benefits are expected to extend indefinitely into the future and would directly and indirectly contribute to the recovery of bull trout subpopulations and designated critical habitat in the lower reaches of Warm Springs Creek and throughout the Upper Clark Fork River core area by improved water quality.

Despite these overall expected benefits, there is a potential for short-term and long-term adverse effects on bull trout critical habitat while implementing the proposed remedial actions. Short-term adverse effects from increased sediment and COCs would be small in magnitude, short in duration, and temporary in nature. Construction BMPs and conservation measures associated with proposed remedial actions should minimize the potential for short-term sediment effects. If they should occur, these precautions would likely minimize their magnitude and duration.

Potential long-term adverse impacts from the consolidation of stream channels and placement of berms in the floodplain vary in their significance to bull trout and bull trout habitat. The loss of wetland habitat as a result of channel consolidation in Section 32 is relatively insignificant to bull trout directly, but may have indirect effects related to prey recruitment. The establishment of four perpendicular berms may trap individual bull trout as flood waters recede; however, the likelihood of entrapment is low at current population levels. The reduction of undercut bank habitat as a result of channel reconstruction would reduce the amount of refugia habitat (i.e. undercut banks) for bull trout. However, the removal of undercut bank habitat is required to improve bank stability and riparian condition, to improve water quality. Overall, it is expected that any residual adverse effects would be outweighed by the long-term benefits expected to accrue for bull trout and bull trout critical habitat once remediation activities have been completed and stream side vegetation is re-established.

B. Species Response to the Proposed Action

Increased sediment and contaminants from the proposed activities has the potential to impact adult and juvenile life stages of bull trout within the action area during the proposed project. Increases in sedimentation and toxic metals may affect bull trout primarily through behavioral effects, including abandonment of cover, short-term reductions in feeding rates and success, and minor physiological stress and may alter migratory behavior. Elevated sediment levels are anticipated to be sporadic, but will likely be associated with intensified construction periods or precipitation events that mobilize sediment from treatment areas. Increases in sediment and contaminants and the associated impacts to bull trout are considered more than insignificant or inconsequential, and are anticipated to occur during the 4-year implementation period.

The Service anticipates that the proposed action will result in infrequent multiple pulses of sediment and increases in COC during construction activities for durations from less than a few hours to weeks, for the first 3 years of implementation and may occur any time during the year. However, population numbers in the action area are very low, and the Service does not anticipate impacts associated with increases in sedimentation and changes to COC would rise to the level of lethal take.

Long-term benefits associated with reduced contaminant input would improve habitat conditions for bull trout. The likelihood of pulse discharge of copper and zinc salts during high intensity precipitation events responsible for past fish kills would likely be removed. While restoration of bull trout habitat is not the ultimate objective of the selected remedy, the long-term outcome of these remediation activities would likely be more suitable aquatic habitat for bull trout.

The loss of small side channels and removal of LWD in Section 32 is relatively insignificant to bull trout directly, but may have indirect effects related to prey recruitment and cover. The establishment of four perpendicular berms may trap individual bull trout as flood waters recede and overtime reduce floodplain function for providing healthy riparian vegetation. The loss of undercut bank habitat would eliminate some refugia habitat for bull trout until reconstructed stream banks are vegetated. Overall, it is expected that any residual adverse effects would be outweighed by the long-term benefits expected to accrue for bull trout and bull trout critical habitat once remediation activities have been completed from improved water quality.

B. Effects of the Action to Designated Critical Habitat

The specific effects of the proposed action on critical habitat are virtually the same as those described in the preceding section, because the PCEs considered under critical habitat involve the same habitat parameters analyzed in the matrix (Table 4). Consequently, those discussions and analysis of effects apply here; and therefore, will not be repeated. The primary factor by which bull trout and bull trout critical habitat have the potential to be adversely affected by the proposed action, in the short-term, is through changes PCE 6 (sediment) and PCE 8 (chemical contamination). The proposed action would impacts PCE 2 (barriers) and 4 (LWD, pool frequency and quality, and stream bank condition). Long-term benefits are expected to extend indefinitely into the future and would directly and indirectly result in improvements to the functional condition of PCE 2, 4, 6, and 8. Impacts to PCE 2, 6, and 8 are the same as those discussed above under the appropriate habitat indicator. The discussion below focuses on PCE 4 because the proposed action has the potential to result in minor long-term adverse effects.

Implementation of the selected remedy will also adversely affect PCE 4 in the short-, and possibly the long-term. The proposed action in Section 32 includes reconstruction of the channel and removal of LWD in order to convey flows during runoff events and reduce the risk of channel avulsions. Generally, actions to improve conveyance of flood flows result in reduced habitat complexity. The expected decrease in LWD would remove in-stream structure and cover preferred by bull trout. In areas with large boulders, undercut banks, or other sufficient cover, the impact of less LWD would be minimal. However, in many areas, LWD provides the only cover present, thus its removal and future absence may render these stream reaches unsuitable for bull trout. While this may decrease overall channel complexity, it is expected to increase habitat conditions favorable to bull trout. This includes providing adequate base flows, stable streambanks, active floodplain connections, and large pools. Bank reconstruction in the Lower Warm Springs project area would remove a significant portion of existing undercut banks, thereby degrading bull trout habitat in the short-term. However, long-term bank stability and shallower bank slopes would improve water quality, create productive shallow-water habitats, and would replace undercut bank habitat with in-channel structure provided by willow plantings. The area affected by the construction of flood control berms is small and would only become active once every 1 to 25 years; therefore, PCE 4 would retain the ability to be functionally established to serve the intended conservation role for the species.

VII. Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Terrestrial and aquatic habitat (including bull trout critical habitat) conditions in the Upper Clark Fork River core area are anticipated to improve as a result of implementation of the Upper Clark Fork River Basin Restoration Plans. In December 2011, the State of Montana approved a restoration plan that allocated 110 million dollars in natural resource damage settlement funds for the restoration of groundwater, aquatic, and terrestrial resources in the Upper Clark Fork River core area.

Residential development in the Upper Clark Fork River core area is anticipated to increase and can affect the species and critical habitat. Commercial and residential development on private lands often occur along stream corridors, which could lead to stream channel alterations exacerbating water temperature, nutrient, and bank stability problems. Private and Montana Department of Natural Resources and Conservation (DNRC) salvage harvest and associated road construction may increase in the future and could lead to potential decreases in woody debris contributions, increase sediment, and increase summer stream temperatures within the action area. However, a Habitat Conservation Plan (HCP) completed in 2011 is being implemented on DNRC forest trust lands and is designed to protect native fish relative to forest management and associated actions, which should improve habitat value for bull trout on state school trust lands located in the action area.

Angler harvest and poaching has been identified as one reason for bull trout decline (U.S. Fish and Wildlife Service 2002b). It is likely that recreational fishing in known spawning streams in the fall will likely increase as the general residential population in western Montana increases. However, recent changes to fishing regulations may reduce these impacts to some degree. In addition, misidentification of bull trout has been a concern because of the similarity of appearance with brook trout. Although harvest of bull trout is illegal, incidental catch does occur but the fate of the released bull trout is unknown. Some level of hooking mortality is likely due to the associated stress and handling of the release (Long 1997).

The harvest of bull trout, either unintentionally or illegally, is likely having direct effects on the local resident bull trout population and migratory adfluvial component of bull trout populations in the action area. The extent of the effect will be dependent on the amount of increased recreational fishing pressure, which is a function of the increased number of fishermen utilizing the fish resources each season. Illegal poaching is difficult to quantify, but generally increases in likelihood as the human population in the vicinity grows (Ross 1997).

Cumulative effects within the core areas are reflected in bull trout population numbers and life history forms. All core areas are at risk of increased activities and concern for the viability and effects to bull trout populations is well documented (U.S. Fish and Wildlife Service 2005a). Clearly, activities occurring instream within channels on private lands at the same time as the proposed federal activities are occurring on the same stream may result in additive adverse effects to bull trout, at least in the short-term. However, some non-federal activities will likely also be targeted for improving conditions for bull trout from existing levels over the long-term and will work in concert with federal actions toward recovery of bull trout in some instances.

VIII. Conclusion

Jeopardy analysis of Columbia Basin Bull Trout Population

After reviewing the current status of bull trout, the environmental baseline (including effects of federal actions covered by previous BOs) for the action area, the effects of remedial actions, and the cumulative effects, it is the Service's determination that the actions as proposed, are not likely to jeopardize the continued existence of bull trout. This conclusion is based on the magnitude of the project effects (to reproduction, distribution, and abundance) in relation to the listed population. Implementing regulations for section 7 (50 CFR 402) defines "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species."

Jeopardy determinations for bull trout are made at the scale of the listed entity, which is the coterminous United States population (64 FR 58910). This follows the April 20, 2006, analytical framework guidance described in the Service's memorandum to Ecological Services Project Leaders in Idaho, Oregon, and Washington from the Assistant Regional Director – Ecological Services, Region 1 (U.S. Fish and Wildlife Service 2006). The guidance indicates that a BO should concisely discuss all the effects and take into account how those effects are likely to influence the survival and recovery functions of the affected IRU(s), which should be the basis for determining if the proposed action is "likely to appreciably reduce both survival and recovery of the coterminous United States population of bull trout in the wild."

As discussed earlier in this BO (see Part III.), the approach to the jeopardy analysis in relation to the proposed action follows a hierarchal relationship between units of analysis (i.e., geographical subdivisions) that characterize effects at the lowest unit or scale of analysis (the local population) toward the highest unit or scale of analysis (the Columbia River IRU) of analysis. The hierarchal relationship between units of analysis (local population, core areas) used to determine whether the proposed action, is likely to jeopardize the survival and recovery of bull trout. As mentioned previously, should the adverse effects of the proposed action not rise to the level where it appreciably reduces both survival and recovery of the species at a lower scale, such as the local or core population, the proposed action could not jeopardize bull trout in the coterminous United States (i.e. range wide). Therefore, the determination will result in a no-jeopardy finding. However, should a proposed action cause adverse effects that are determined to appreciably reduce both survival and recovery of the species at a lower scale of analysis (i.e., local population), then further analysis is warranted at the next higher scale (i.e., core area). Our rationale for this no jeopardy conclusion is based on the following:

1. Implementation of the proposed action is not anticipated to reduce the reproduction, numbers, or distribution of bull trout within the Upper Clark Fork River core area or action area to the degree that survival or recovery is reduced.
2. Minimization measures employed by the EPA during implementation of the proposed action are likely to be effective in reducing sediment and COCs generated by the project, thus reducing short-term adverse effects to bull trout.
3. The proposed action is anticipated to result in improvements to water quality that will likely result in improvements in habitat that restore conditions necessary for survival and reproduction of bull trout in the action area.

Implementing regulations for section 7 (50 CFR 402) defines "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of the proposed remedial actions, and the cumulative effects, it is the Service's conclusion that the action as proposed is not likely to jeopardize the continued existence of bull trout.

Adverse modification of bull trout critical habitat analysis

Guidance for analysis of designated critical habitat for bull trout was provided in the final rule (FR 70, No 185, 56211-56311) and in the Director's December 9, 2004, memorandum and was promulgated in response to litigation on the regulatory standard for determining whether proposed federal agency actions are likely to result in the "destruction or adverse modification" of designated critical habitat under Section 7(a)(2) of the Act. The Director's December 9, 2004, memorandum outlines interim measures for conducting Section 7 consultations pending the adoption of any new regulatory definition of "destruction or adverse modification." Consequently, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat. Critical habitat is defined in section 3 of the Act "as the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical and biological features essential to the conservation of the species and that may require special management considerations or protection; and specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species."

After reviewing the current status of the Upper Clark Fork River CHSU and its relationship to the Upper Columbia River bull trout population, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is the Service's determination that the actions as proposed are not likely to destroy or adversely modify the bull trout critical habitat within the CHSU. Pursuant to current national policy and the statutory provisions of the Act, destruction or adverse modification is determined on the basis of whether, with implementation of the proposed action, the affected critical habitat would remain functional (or retain the current ability for the primary constituent elements to be functionally established) to serve the intended conservation role for the species.

The proposed project is likely to result in short-term adverse and long-term benefits to PCE 2, 4, 6, and 8. Short-term adverse effects are largely small in magnitude and temporary in nature, and are outweighed by the magnitude of beneficial effects from improved water quality. The proposed action will result in minor adverse effects to PCE 4 from the construction of perpendicular berms within the floodplain. However, the scale of impacts to floodplain function is small compared to the action area and will not significantly reduce the overall function of PCE 4 to provide its intended conservation role.

The proposed construction methods, BMPs, and conservation measures would also greatly reduce the potential for and magnitude of adverse effects from increased sediment delivery and COCs. The proposed action would result in the removal large quantities of contaminated sediment from streambanks and floodplains, thereby improving water quality. These improvements in water quality would likely result in improved functionality of PCEs 2, 4, 6, and 8. As a result, implementation of the proposed project is not likely to destroy or adversely modify bull trout critical habitat at the range-wide scale.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are not discretionary and must be undertaken by the Administration so that they become binding conditions of any contract issued to a road contractor, as appropriate, for the exemption in section 7(o)(2) to apply. The EPA has a continuing duty to regulate and oversee the activity covered by this Incidental Take Statement. If the EPA fails to assume and implement the terms and conditions of the Incidental Take Statement, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the EPA must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement [50 CFR 402.14(i)(3)].

Amount or Extent of Take Anticipated

The Service anticipates that project activities will likely result in incidental take of bull trout in the form of harm, harassment or mortality related to the expected short-term degradation of aquatic habitat parameters as a result of increased levels of activity created sediment and COCs. Activity-created sediment and COCs, when additively combined with increased background levels, may impact bull trout habitat parameters including sediment and substrate embeddedness. Sedimentation from associated project activities is anticipated to have short-term adverse effects and likely result in sub-lethal affects to sub-adult and adult life history stages by harming or impairing feeding and sheltering patterns of bull trout. In addition, the Service anticipates that the stranding of bull trout behind flood control berms would likely result in mortality. The potential for standing bull trout is related to the frequency and magnitude of flow events. Based on flood frequency, the Service anticipates stranding will occur once every 5 years.

The Service acknowledges that the amount of incidental take of bull trout resulting from the project will be difficult to detect due to: (1) primarily nocturnal activity patterns, tendency to hide in or near the substrate, small body size and cryptic coloration and behavior of juvenile and sub-adult bull trout; (2) the low likelihood of finding an injured or dead individual in the relatively complex habitats in the action area; (3) high rate of removal of injured individuals by predators or scavengers; and (4) the amount and duration of recreation use of the stream channel coinciding with the presence of individual bull trout is difficult to predict. Bull trout use of the project area likely fluctuates seasonally, and there are no seasonal access restrictions to the stream channel. For these reasons, the Service has determined that the actual amount or extent of the anticipated incidental take is difficult to determine. In these cases, we use surrogates to measure the amount or extent of incidental take, and determine when the amount of take anticipated has been exceeded. In this BO, for actions that increase sedimentation, the Service uses length of occupied stream affected, ground disturbance and instream construction (2.54 miles), and duration of the project (3 construction seasons). For activities that may result in stranding of bull trout, the Service uses frequency of high flow events and numbers of bull trout in the action area. If at any time during implementation of the project, activities differ from those described in the proposed action, then the amount of take the Service anticipates would be exceeded.

The Service anticipates that incidental take of bull trout will occur intermittently during the three construction seasons and will typically be associated with instream construction activities. In addition, the Service anticipates that take would occur as a result of stranding bull trout behind the flood control berms when high flows occur. Based on current population levels and high flow frequency in the action area, the Service anticipates that no more than 2 bull trout may become stranded every 5 years. This portion of the Warm Springs Creek supports adult and sub-adult bull trout and foraging, migratory, and overwintering habitat; it does not provide spawning and rearing habitat. Thus, the take would apply to sub-adult and adult bull trout within the project area. If at any time during implementation of the project, instream construction activities differ from those described in the proposed action., then the amount of take the Service anticipates would be exceeded. The Service anticipates the proposed action will result in improvements to water quality such that stream water quality meets the 2011 Anaconda Regional Water, Waste, and Soils Operable Unit, Record of Decision performance standards (see Table 3-1 in U.S. Environmental Protection Agency 2011).

Effect of the Take

In this BO, the Service determined that the extent and type of incidental take described is not likely to appreciably reduce the survival and recovery of bull trout in the Upper Clark Fork River core area, and by extension not likely to appreciably reduce the survival and recovery of bull trout at the Clark Fork River Management Unit and the larger scale of the Columbia River Interim Recovery Unit.

Reasonable and Prudent Measures

Incidental take statements typically provide reasonable and prudent measures which are expected to reduce the amount of incidental take. Reasonable and prudent measures are those measures necessary and appropriate to minimize the incidental take resulting from the proposed action. These reasonable and prudent measures are non-discretionary and must be implemented by the Administration in order for the exemption in section 7(0)(2) to apply. The Service concludes the following reasonable and prudent measure(s) are necessary and appropriate to minimize impacts of incidental take of bull trout.

1. Identify and implement means to reduce the potential for incidental take of bull trout resulting from sedimentation, increases in COCs, and stranding due to ground disturbing activities in the action area.

2. Monitor both BMPs and conservation measures to ensure that actions and projects comply with the BA and BO and the incidental take associated with these elements of the project is not exceeded.

3. Implement reporting requirements as outlined in the terms and conditions below.

Terms and Conditions

The following terms and conditions implement the reasonable and prudent measures as described above.

1. To fulfill reasonable and prudent measure #1, the following terms and conditions shall be implemented:

   a). The EPA shall implement all appropriate conservation measures and Best Management Practices (BMPs) as identified in the Project Description of this BO including:

      i. The EPA shall implement the revegetation plan as described in section 5.9 of the Draft Remedial Action Work Plan (Atlantic Richfield 2013).

      ii. The EPA shall develop and implement a grazing management plan to ensure riparian vegetation becomes established and maintained.

   b). The EPA shall implement water quality monitoring as described in the Anaconda Regional Water, Waste, and Soils Operable Unit, Record of Decision (see Table 3-1 in U.S. Environmental Protection Agency 2011).

   c). The EPA shall develop a catch and transport plan for bull trout stranded behind flood control berms (Appendix A).

2. To fulfill reasonable and prudent measure #2 the following terms and conditions shall be implemented:

   a). All waste fuels, lubricating fluids, herbicides, and other chemicals will be collected and disposed of in a manner that ensures that no adverse environmental impact will occur. Construction equipment will be inspected daily to ensure hydraulic, fuel and lubrication systems are in good condition and free of leaks to prevent these materials from entering any stream. Vehicle servicing and refueling areas, fuel storage areas, and construction staging and materials storage areas will be sited and contained properly to ensure that spilled fluids or stored materials do not enter any stream.

   b). Following the implementation of BMPs and conservation measures and until such time measures are no longer necessary, the EPA shall monitor BMPs and conservation measures for effectiveness as described in Appendix B of this BO including:

      i. The EPA will ensure the replacement or removal of temporary crossings identified in the project description will provide for passage of adult and sub-adult bull trout.

      ii. As needed, the EPA shall implement the Catch and Transport Plan described in Appendix A of this BO.

3. To fulfill reasonable and prudent measure #3 the following terms and conditions shall be implemented:

   a). Upon locating dead, injured, or sick bull trout, notification must be made within 24 hours to the Service's Montana Field Office at (406)449-5225. Record information relative to the date, time, and location of dead or injured bull trout when found, and possible cause of injury or death of each fish, and provide this information to the Service.

b). The EPA shall provide summaries by December 31 each year detailing project progress and compliance monitoring of the terms and conditions in this BO.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, terms and conditions 1, 2, and 3 are not adhered to, the level of incidental take anticipated in the BO may be exceeded. Such incidental take may represent new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Service retains the discretion to determine whether non-compliance with terms and conditions 1, 2, and 3 results in take exceeding that considered here, and whether consultation should be reinitiated. The EPA must immediately provide an explanation of the causes of any non-compliance and review with the Service the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The following conservation recommendations are discretionary measures that the Service has determined are consistent with this obligation and therefore should be carried out by the EPA:

1. To progress toward bull trout recovery in the Clark Fork River Recovery Unit, the Service encourages the EPA to incorporate recommended recovery tasks of the draft and subsequent final bull trout recovery plan (U.S. Fish and Wildlife Service 2002b).

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

Reinitiation Notice

This concludes formal consultation for bull trout and bull trout critical habitat on the. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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Appendix A. Catch and Transport Plan

Staging and Sequence of work

Oversight personnel will work with the Contractor to plan the staging and sequence for work area isolation, fish capture and removal, and dewatering. This plan will consider the size and channel characteristics of the area to be isolated, the method(s) of dewatering (e.g., diversion with bypass flume or culvert; diversion with sandbag, sheet pile or similar cofferdam; etc.), and what sequence of activities will provide the best conditions for safe capture and removal of fish. Where the area to be isolated is small, depths are shallow, hiding cover is limited, and/or conditions are conducive to fish capture, it may be possible to isolate the work area and remove all fish life prior to dewatering or flow diversion. Where the area to be isolated is large, water is deeper, uncut banks and other hiding cover is present, flow volumes or velocities are high, and/or conditions are not conducive to easy fish capture, it may be necessary to commence with dewatering or flow diversion staged in conjunction with fish capture and removal.

If pumps are used to temporarily bypass water or to dewater residual pools or cofferdams, pump intakes will be screened to prevent aquatic life from entering the intake. If the Oversight Personnel has confirmed that all fish have been successfully excluded from the area then pumps may be operated without a screened intake.

Fish Capture and Removal

Methods for safe capture and removal of fish from the isolated work area are described below. These methods are given in order of preference. At most locations, a combination of methods will be necessary.

Where bull trout and non-listed fish may be present, the Oversight Personnel will ensure that fish capture and removal operations adhere to the following minimum performance measures or expectations:

1. Only dip nets and seines composed of soft (non-abrasive) nylon material will be used.
2. The operations will confirm success of fish capture and removal before completely dewatering or commencing with other work within the isolated work area.
3. Fish will not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator.
4. A plan for achieving efficient return to appropriate habitat will be developed before the capture and removal process.
5. Every attempt will be made to release ESA-listed specimens first.

Electrofishing

Electrofishing – Prior to dewatering, use electrofishing only where other means of fish capture may not be feasible or effective. The protocol for electrofishing includes the following:

- If fish are observed spawning during the in-water work period, electrofishing shall not be conducted in the vicinity of spawning adult fish or active redds.
- Only Direct Current (DC) or Pulsed Direct Current (PDC) shall be used.

- Conductivity <100 use voltage ranges from 900 to 1100. Conductivity from 100 to 300 then use voltage ranges from 500 to 800. Conductivity greater than 300 then use voltage to 400.
- Begin electrofishing with minimum pulse width and recommended voltage and then gradually increase to the point where fish are immobilized and captured.
- Turn off current once fish are immobilized.
- Do not allow fish to come into contact with anode.
- Do not electrofish an area for an extended period of time.
- Remove fish immediately from water and handle as described below.
- Dark bands on the fish indicate injury, suggesting a reduction in voltage and pulse width and longer recovery time.

Seining

Seining will be the preferred method for fish capture. Other methods will be used when seining is not possible, or when/after attempts at seining have proven ineffective. Seines, once pursed, will remain partially in the water while fish are removed with dip nets. Seines with a "bag" minimize handling stress are preferred. Seines with a bag are also preferred where obstructions make access to the water (or deployment/ retrieval of the seine) difficult. In general, seining will be more effective if fish, especially juvenile fish, are moved (or "flushed") out from under cover. Methods which may increase effectiveness and/or efficiency include conducting seining operations at dawn or dusk (i.e., during low-light conditions), in conjunction with flushing of the cover. In flowing waters, and especially where flow volume or velocity is high or moderately high, seines that employ a heavy lead line and variable mesh size are preferred. Small mesh sizes are more effective across the full range of fish size (and age class), but also increase resistance and can make deployment/ retrieval more difficult in flowing waters. Seines which use a small mesh size in the bag (or body), and a larger, less resistant mesh size in the wings may under some conditions be most effective and efficient.

Baited Minnow Traps

Baited minnow traps are typically used before and in conjunction with seining. Traps may be left in the isolated work area overnight. Traps will be inspected at least four times daily to remove captured fish and thereby minimize predation within the trap. Traps will be checked more frequently if temperatures are in excess of 15 degrees C. Predation within the trap may be an unacceptable risk when minnow traps are left in place overnight; large sculpin and other predators that feed on juvenile fish are typically much more active at night. The Oversight Personnel will consider the need and plan for work outside daylight hours (i.e., inspection and removal) before leaving minnow traps in-place overnight.

Dip Nets

Dip nets will be used in conjunction with seining. This method is particularly effective when employed during gradual dewatering or flow diversion. To be most effective and to minimize stress and risk of injury to fish (including stranding), the Oversight Personnel will coordinate fish capture operations with plans for dewatering or flow diversion. Plans for dewatering and/or flow diversion will proceed at a measured pace (within constraints), to encourage the volitional downstream movement of fish, and reduce the risk of stranding. The Oversight Personnel shall monitor the dewatering process to insure that water is removed slowly to allow for fish capture and preclude stranding. Plans for dewatering and/or flow diversion will not proceed unless there are sufficient staff and materials on-site to capture and safely remove fish in a timely manner. Generally this will require a minimum of two persons, but the Oversight Personnel may find that some sites (especially large or complicated sites) warrant or require a more intensive effort (i.e., additional staffing). Once netted, fish will remain partially in water until transferred to a bucket, cooler, or holding tank. Dip nets which retain a volume of water ("sanctuary nets") are preferred. However, sanctuary nets may be ineffective where flow volume or velocity is high or moderately-high (i.e., increased resistance lessens ability to net and capture fish). In addition, where water depths are very shallow and/or fish are concentrated in very small receding pools or coarse substrate, "aquarium" nets may be a better, more effective choice.

Fish Handling, Holding, and Release

Fish handling will be kept to the minimum necessary to remove fish from the isolated work area. Fish capture and removal operations will be planned and conducted to minimize the amount and duration of handling. The operations will maintain captured fish in water to the maximum extent possible during seining/netting, handling, and transfer for release.

Individuals handling fish will ensure that their hands are free of harmful and/or deleterious products, including but not limited to sunscreen, lotion, and insect repellent.

The operations will ensure that water quality conditions are adequate in the buckets, coolers, or holding tanks used to hold and transfer captured fish. The operations will use aerators to provide for clean, cold, well-oxygenated water, and/or will stage capture, temporary holding, and release to minimize the risks associated with prolonged holding. The Oversight Personnel will ensure that conditions in the holding containers are monitored frequently and operations adjusted appropriately to minimize fish stress. If bull trout will be held for more than a few minutes prior to release, the Oversight Personnel will consider using dark-colored, lidded containers only. Bull trout will not be held in containers for more than 10 minutes, unless those containers are dark colored, lidded, and fitted with a portable aerator; small coolers meeting this description are preferred over buckets. Bull trout will not be kept in the same holding container or area with aquatic species that may prey on or injure them.

The operations will provide a healthy environment for captured fish, including low densities in holding containers to avoid effects of overcrowding. Large fish will be kept separate from smaller fish to avoid predation. The operations will use water-to-water transfers whenever possible.
The release site(s) will be determined by the Oversight Personnel. The Oversight Personnel will consider habitat connectivity, fish habitat requirements, seasonal flow, water temperature, and the duration and extent of planned in-water work when selecting a fish release site(s). If conditions upstream of the isolated work area may become unfavorable during construction, then fish will not be released to an upstream location. However, the Oversight Personnel will also consider whether planned in-water work presents a significant risk of downstream turbidity and sedimentation; fish released to a downstream location may be exposed to these conditions. Site conditions may warrant releasing fish both upstream and downstream, or relocating fish at a greater distance (e.g.,

thousands of feet or miles), so as to ensure fish are not concentrated in areas where their habitat needs cannot be met.

Appendix B. MONITORING AND MAINTENANCE ACTIVITIES

Water Quality Monitoring: The design presented in the FDR represents a partial removal; therefore, surface water performance and compliance monitoring would be required. Conceptually, stream water quality samples would be collected eight times per year at USGS monitoring station 12323770 (i.e., ARWW&S OU sampling station WSC-6). Samples would be collected during high and low flows, but would focus on the high flow period. If elevated concentrations of COCs are detected under this monitoring program, the stream would be re-evaluated and additional monitoring or contingency remedies may be required. Final surface water monitoring and maintenance requirements would be established under separate site-wide monitoring and maintenance plans (CDM Smith 2012).

Turbidity monitoring, similar to the program used during the Milltown Dam removal, should be conducted during RA construction in the stream corridor to ensure that BMPs designed to minimize sediment transport to the stream are functioning properly. Protocols for inspection and maintenance would be set forth in a final Inspection and Maintenance Plan, to be developed after RA construction is completed.

Streambank vegetation Monitoring: Monitoring objectives address the level (qualitative or quantitative), the purpose, and the method of monitoring. The general objectives of the riparian corridor performance monitoring evaluations include:

- Monitoring bank stabilization and erosion;
- Evaluating whether streambank vegetation cover is providing short-term and long-term channel stability;
- Evaluating the status of noxious weed populations so that weeds are not compromising establishment of permanent vegetation and decreasing species diversity; Identifying maintenance and corrective actions; and
- Providing record keeping and reporting to document monitoring and maintenance activities.

The purpose of monitoring following seeding is to evaluate the success of the propagation effort and identify maintenance activities, as necessary, to ensure quick establishment of species in the first few years after construction. Annual vegetation monitoring will include both qualitative and quantitative measurements.

Qualitative: Qualitative vegetation monitoring will be used to evaluate (on an annual basis) general site conditions, uniformity of vegetation cover and presence of bare areas, assessment of reproduction effort, development of species lists, identification of noxious weeds infestation and location of erosive areas. The information will be used to prescribe the appropriate management or maintenance item as needed. Riparian site-wide vegetation monitoring will be predominantly qualitative in the first year following seeding. The first 3 years of riparian corridor stability monitoring will be considered the short-term monitoring phase and consists of predominately qualitative.

Quantitative: Quantitative analyses will be part of the long-term monitoring phase and will be used to measure canopy cover, woody species survival, describe the plant community structure and performance over time. Measurement techniques will remain constant to ensure consistency with earlier measurements. Permanent monitoring locations will be established to provide a consistent frame of reference and reduce year-to-year variability. The number and location of monitoring plots/transects will be based on the total area of post-construction bank treatments.

Both qualitative and quantitative monitoring are intended to evaluate progress toward achieving project goals and objectives. Long-term monitoring or quantitative monitoring will focus on collecting data necessary to calculate the metrics to measure the performance of the remedial actions for each project.

Revegetation Objectives

The primary objective of streambank revegetation along the reconstructed reaches of Warm Springs Creek and Willow Creek remedial action is the establishment of native species with deep, binding roots to provide long-term stability to the stream channels. Monitoring and performance targets for WSC and WC focus on the establishment of riparian revegetation and bank stabilization success. Vegetation measurements will be compared to benchmark performance standards to gauge the progress of vegetation establishment towards performance standards. Performance targets are based on the use of standard methodology for data collection that is repeatable and consistent between years to generate comparable data.

Monitoring of canopy cover by species (Daubenmire, 1959) quantifies total plant cover and species composition. These data are used to evaluate whether species are withstanding hydrologic fluctuations, wildlife foraging, and other natural influences and reestablishing following completion of construction activities. Vegetation is the most effective tool in controlling surface erosion and providing soil stability. Recording litter, rock and bare ground cover further substantiates erosion protection capabilities on site. Monitoring of canopy cover by species and photo-monitoring will be performed to provide a record over time around the evolution of the vegetation community as site vegetation continues to mature.

MONITORING OVERVIEW

Streambank Treatments: Bioengineering techniques rely on plants to establish and once established vegetation provides deep penetrating roots that hold soil in place, stems deflect current and slow local flow velocities. This is typically followed by sedimentation placement and other pioneer plants start to invade and further contribute to stabilization. The key is to ensure that this early-on establishment of plants takes place and this requires early monitoring and possible corrections. Bioengineered banks need to be observed early after project construction for signs of plant survival and development as well as for streambank integrity. Qualitative bank monitoring is expected to include:

- Photographs taken from the same photo point in the same direction so that comparisons of streambank development can occur. These should be taken at high water events and again at low-water periods.

- Ocular description of bank stability– document if toe is undercutting, condition of the upper or lower ends of the treatment, provide estimates of the degree of erosion for each treatment, if needed, with backup photographs.
- High flow impacts - Monitoring inspections after each of the first few floods and/or at least twice a year and once a year thereafter (preferably after the predominant flood season) **for up to 3 years.** Undercutting and severe erosion of the treatment and any substantial scour should be immediately repaired.
    (a) Common signs of bank failure may include: Limited growth of willow cuttings, drying and decomposing of willow materials, eroded backfill materials, large gaps in the fabric and loss of soil in the lifts or bank collapse.
    (b) Cause of failure may include erosion at the bank toe, damage by floods, erosion of backfill, drought during establishment period, incorrect willow or fabric installation, animal grazing, insect problems, competition for tall vegetation, and invasive species colonization.

An example Qualitative Assessment Form is attached for reference.

Woody plant density will be monitored to determine whether bank stabilization treatments successfully established woody vegetation to secure the banks. For woody plants, density is more appropriate in the first years following planting than is cover. Density is a relatively simple means of determining the initial success or mortality of the woody species within the streambank treatments. It is defined by the number of plant stems present per linear feet. This approach will be used to measure post-construction (baseline) levels and subsequent trends in woody plant population numbers in areas of a specified size.
A 6-ft wide belt transect starting above the coir log and centered on standard vegetation transect at select banks will be used to measure density of woody plants. These transects will conform to the configuration of streambank treatment. The permanent transect locations will be based on professional judgment and will be representative of the different bank treatments.

Canopy Cover: Plant cover is the amount of ground covered by plants expressed as a percentage. Two aspects of vegetation performance is revealed by cover sampling. First, total plant cover indicates whether the desired amount of plant cover is present to stabilize the site. Second, cover by species demonstrates how species composition begins and changes through time, and quantifies the abundance of undesirable species.

Canopy cover is an ocular estimate of canopy coverage within an individual plot randomly situated along a permanent line transect. Canopy coverage will be estimated for each seeded/planted species present. The cover of non-seeded species will also be estimated. The percentage of litter, bare soil, woody debris and coarse fragments (>2mm) will be recorded for each plot. The Daubenmire Method of estimating the canopy coverage of each plant species will be used. Individual plot frames with a typical area of 0.5 m^2 will be placed at a specified interval along a permanently located transects.

The Daubenmire Method is applicable to a wide variety of vegetation types dominated by grasses and young woody vegetation. Rather than use Daubenmire's cover classes (ranges of cover values), canopy coverage is estimated to the nearest percent. Data will be reported in tables with columns that identify taxa, average cover, relative cover, diversity and frequency.

Monitoring success requires an effective sampling design to produce reliable and repeatable data that can be used to determine performance targets. Permanent monitoring transects will be located along approximately 20% of the treated streambanks (CFR Reach A Phase 1, 2012). To ensure comparable data and frequencies for the duration of monitoring, the following factors remain constant throughout the monitoring period: monitoring locations, transect length, belt transect width, plot size and number of sample plots per transect.

Noxious weeds. Weeds will be a long-term management need due to the extent of soil disturbance that will occur during remediation actions and current land use. Noxious weeds are currently present within, adjacent to and upstream of the project area. As a result of construction activities, weeds will likely be widely distributed in both project areas. Management of noxious weeds will be performed within both project areas with the goal that they contribute <5% of the total live vegetation cover within the monitoring area and that they are widely spaced and infrequently observed.. Noxious weeds will be managed in accordance with state of Montana, Anaconda-Deer Lodge County regulations, and the Noxious Weed Control Act (MCA 7-22-2101 through -2154). Recommendations for areas requiring weed control will be identifiedduring both short-term and long-term monitoring and may include the method and means of weed control to protect forbs and woody species from injury to herbicides.

Wetlands. Impacts to wetlands are likely as a result of the RA construction and documented under the Upper Clark Fork River 4-step Wetland Mitigation Process following completion of RAs. As necessary, additional wetland assessment will be performed by a qualified wetland specialist to clearly demarcate any wetlands that exist adjacent to work areas prior to construction. Impacts or disturbances, as stated in the RAWP, are to be minimized or avoided to the extent practicable and when the remedy allows.

A new wetland delineation will be completed within five years after RA construction completion to show that the acreage and functional score for the project sites meets or exceeds the wetland score established prior to construction. The functional evaluation will follow the procedure detailed in the Evaluation Form for Determining Wetland Functional Value and Effective Wetland Area in Upper Clark Fork River Superfund Sites (Atlantic Richfield, 1992). Comparisons will be made between the pre- and post-RA functional assessments and FEWA in order to evaluate and summarize the success for the project in meeting the "no net loss" wetlands goal for Superfund Sites.

Browse. While browse is not being proposed as a performance target, browse by wildlife can be a factor influencing percent cover and plant survival and for this reason it will be indirectly evaluated through monitoring. The effect of browse on establishing streambank vegetation will be evaluated by recording the level of browse on individual plants monitored along belt transects. The level of browse will be assigned to each monitored plant. The following categories will be used:

0: No browse;

1: Mild browse – less than 50% of current year's growth browsed;

2: Mild browse – greater than 50% of current year's growth browsed;

3: Moderate browse – two to three year old growth exhibits browse;

4: Heavy browse – browse has resulted in arrested growth form or plant mortality

Monitoring Schedule and Frequency

Seeded species typically take several years following revegetation to establish which during this time the relative abundance of species can shift. Vegetation monitoring will have a short-term and a long-term component. The purpose of the short-term or qualitative monitoring across all the treated streambanks and wetlands is to determine the initial success of the seeding and planting efforts in the first 3 years following seeding. Long-term or quantitative monitoring assesses the development of the riparian plant community from which the permanence of vegetation stands can be evaluated. Additionally, long-term monitoring will provide information that can be used to select appropriate management actions that can enhance vegetation development. See **Table 1** for a breakdown of the expected monitoring schedule.

Table 1. Monitoring schedule

Monitoring Component	Monitoring Methods	Schedule [A]
Vegetation canopy cover on streambanks	Qualitatively – visual observations	Year 1-3
	Transects/Daubenmire plots	Year 4-10 until performance standards achieved
Bioengineering assessment	Qualitatively – completion of form	Year 1 all banks Years 2 and 3 as needed following runoff
Woody density on streambanks	Belt transects	Year 1 (baseline), 2, 3, 5
Browse	Belt transects (selected willow stems on bank treatments will be measured for length)	Year 1 (baseline), 2, 3, 5
Noxious weed cover	Qualitatively- visual observations	Year 1-3
	Transects/Daubenmire plots	Years 4- 10 until performance standards achieved

Long-term or quantitative monitoring will begin during year 2 following initial project seeding. Annual quantitative monitoring will indicate changes in plant species composition based on site conditions and provide data to evaluate the effectiveness of bioengineering techniques. Monitoring will be conducted on Willow Creek and Warm Springs Creek for up to ten years or until performance standards are achieved to assess the development of target revegetation functions and the achievement of specified success criteria. Monitoring will also yield information in support of post-construction contingency measures such as reseeding, replanting, weed control and animal/pest control.